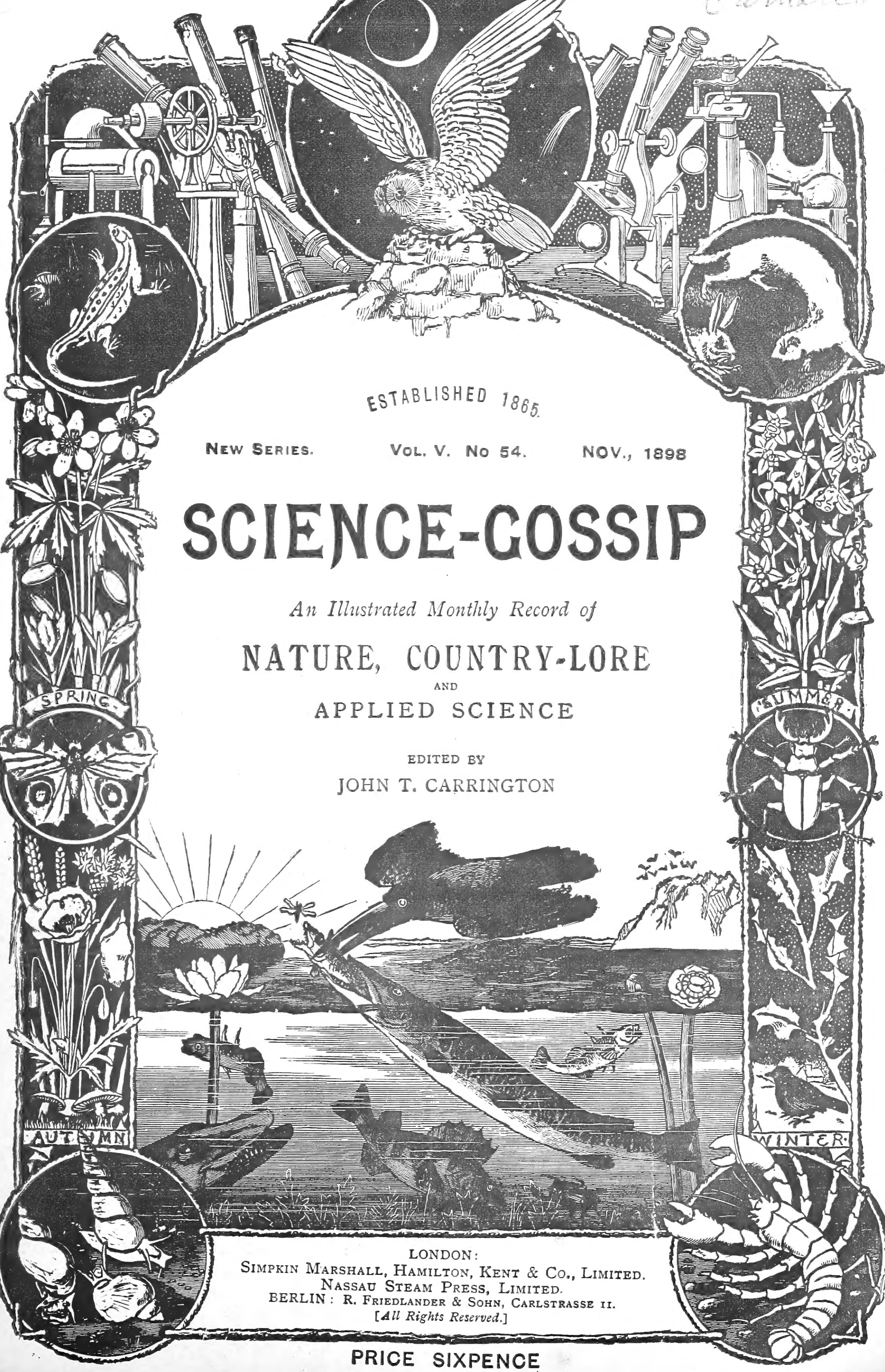
176 Destruction of Carnations



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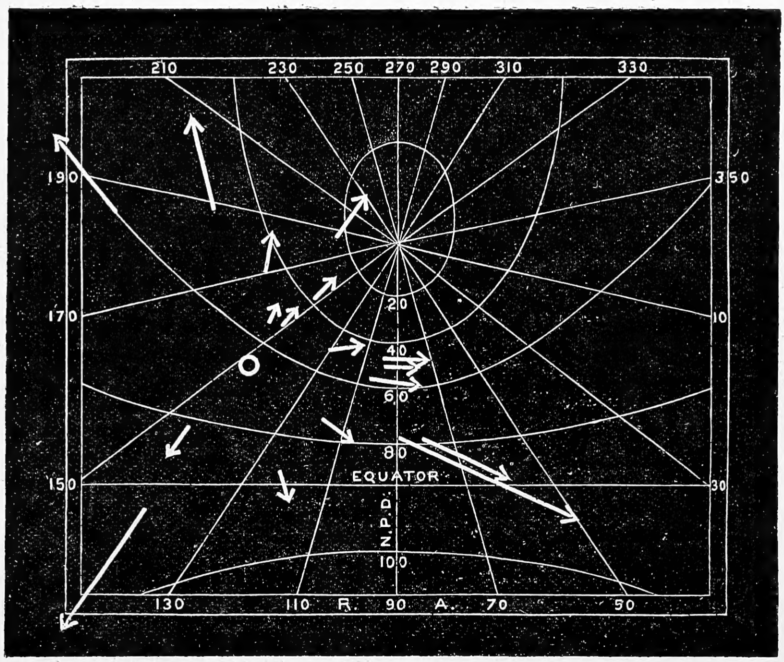
THE NOVEMBER METEORS.

By Frank C. Dennett.

THE records of the past millennium occasionally refer to magnificent meteor showers in the months of October and November. Professor H. A. Newton, in the "American Journal of Science and Arts" for May, 1864, gave a list of thirteen such displays between and including the years 902 and 1833. The earliest of these, 902, occurred on October 12th, and that of 1202 on October 19th. In 1366 the record says: "Twenty-two days of the month of October being past, three months before the death of the king, Don Pedro (of Portugal), there was in the heavens a movement of the stars such as men never before saw or heard. At midnight, and for some time after, all the stars moved from the east to the west, and after being collected together they began to move, some in one direction, others in another. And afterwards they fell from the sky in such numbers, and so quickly together, that as they descended low in the air they seemed large and fiery, and the sky and the air seemed to be in flames, and even the earth appeared as if ready to take fire." It will be remembered that those three dates were given in old style chronology, some days, or, to be more exact, five, seven and eight days respectively, later than the same days of the month now used under the Gregorian calendar. In 1799 the shower was on November 11th, and was observed in South America by Humboldt and Bonpland. In 1833 the phenomenon is recorded on November 12th, and in 1866 on November 13th and 14th.

Since more careful observations have been made these showers are all found to radiate from one spot in the heavens, close to a 5·7 magnitude star marked as *x* Leonis by Bode, situated in the middle of the sickle of Leo. To be quite exact, the position of the radiant spot, as a mean of seventy determinations, is R.A. 149° 28′ and Dec. N., or, as it is sometimes written, +, 22° 52′.



Paths of 17 Leonids observed at Bristol on the morning of Nov. 14th, 1879.
From "The Great Meteoric Shower of November."

These meteor showers are found to recur at intervals of thirty-three years, and therefore the next great display should occur in 1899; but, as in previous returns there have been abundant meteors for a year or two earlier, and three or four years later than the display-in-chief, we have much encouragement to hope that this present month will not prove an exception. Last year, it is true, English observers were not favoured with seeing

the shower; but some American brethren near the western coast did see numbers of these meteors. There is a special reason this November for keeping a sharp look-out. Next year the moon will be full at 10.18 a.m. on November 17th, and therefore above the horizon with such brilliance as to drown the light of all the smaller meteors, and so generally to spoil the effect of a great display. This year, on the contrary, the moon will be new just after midnight on the 14th; therefore, given a fine night, or, more correctly speaking, morning, observers would have the best conditions for witnessing the "shower."

There are peculiarities which these Leonids possess. Their flight is very rapid; for their own real speed has to be added to that of the earth's orbitual motion, because the two paths meet each other. Again, they leave a bright trail behind them, visible for a long time after the meteor has disappeared, and which has a slow motion of its own according to the air currents moving in that high portion of our atmosphere through which the Leonid has passed.

There is added interest in this meteor shower when it is found that the meteorites are travelling along an orbit apparently identical with that of the faint Comet I. 1866, otherwise known as Tempel's Comet, which Dr. Oppolzer found to have a period of thirty-three years and sixty-five days, and which may be expected to be recovered next spring.

The shower itself, according to the investigations of Mr. B. V. Marsh, of Philadelphia, U.S.A., is each year divided into three parts—a preceding, central, and following shower. Thus for the present year the preceding shower may be expected from 9.30 p.m., November 13th, to 9.30 a.m. on the 14th; the central shower from 4.15 to 8.45 p.m. on the 14th; and the following shower from 3 a.m. to 4.30 p.m. on the 15th. There is, however, yet much uncertainty as to the exactness of the times of these displays; therefore a sharp look-out should be kept; indeed, every available time from November 7th to November 20th should be made use of to pick up Leonids, for during the whole of this period meteors bearing the stamp of this shower are apt to put in an appearance. All who wish to help in observing these bodies should consult Mr. W. F. Denning's valuable brochure on the subject (1), reprinted from "The Observatory," which gives some useful hints, with quite a fund of information, on this shower, as well as on that known as the Andromedes. This latter shower appears to have a path identical with that of Biela's Comet, and seems to radiate from a point R.A. 25°, Dec. + 43° near γ Andromedae. These meteors are slow in motion, because the earth's speed has to be subtracted from their own orbitual motion. They have a period of about six and a-half years, and the present year is one when a maximum display should be expected on November 23rd, the drawback being that the moon at that time will be eleven days old. There is one striking difference between these two showers. The Leonids cannot be well observed until after eleven p.m., because the radiant point is below the horizon until near that time. On the other hand, the radiant of the Andromedes is circumpolar in England and therefore always above the horizon. Observations should be made on the early morning of November 23rd after the moon has set, and again during the night and morning of the 23rd and 24th of that month. These meteors usually leave in their wake a train of yellowish sparks. This latter shower may possibly exceed in brilliance that of the Leonids, if it be at all equal to the magnificent displays of 1872 and 1885.

To make one's observations of use, the paths of the meteors should be carefully determined; both the place of their appearance and disappearance should be noted as nearly as possible. Some observers at once mark them down on a globe or map, and this is perhaps as accurate a method as can be followed, and one which involves as little loss of time as any. The paths of seventeen Leonids laid down on a special chart are shown in the illustration, for the loan of which I have to thank Mr. Denning. If ordinary star maps are employed, only the shorter paths can be accurately laid down. The times of meteors of special brilliance should be noted, as perhaps others may observe them also, and then comparisons can be made and the real paths of the meteors determined. If possible the duration of the apparition should be estimated, that their rate of motion may be calculated. The comparative brightness of the meteors with known objects may also be recorded, as well as the colours, both of the meteorites and their trains. Another point to be noted is whether they burst, and, if so, if there is any sound heard. Usually after a meteor bursts the path is continued for a short distance, although it is much less brilliant, and often the direction is slightly altered.

Altogether, given fine weather, there is real inducement to all who have any inclination to behold the superb phenomenon to prepare themselves this November to be on the watch. Already the year has proved itself remarkable, both from the number of comets discovered and from the appearance of the new planet within the orbit of Mars. Possibly it may prove exceptional also for its brilliant meteoric displays. Let every observer, therefore, be on the alert.

60, *Lenthall Road, Dalston, N.E.*

(1) "The Great Meteoric Shower of November," by W. F. Denning, F.R.A.S., Taylor and Francis, 8½ in. × 5⅓, 52 pp. portrait and four diagrams. 1s.

FLOTATION AND ROLLING OF FORAMINIFERA.

By G. H. Bryan, F.R.S.

"IF a mixture of sand and Foraminifera be put into water, the sand will sink and the Foraminifera will float." Such is the dictum which, like the now exploded nostrum about softening coal in caustic potash in order to cut sections, has been repeated by writers innumerable. In the hopes of preventing others from wasting hours over trying to float Foraminifera and sink sand when the task is hopeless, a few remarks may be of use.

The method seems very promising at the commencement of the experiment, for as soon as the sand falls into the water a film of floating particles remains at the top. You examine them under the microscope, confidently expecting to see pure Foraminifera. To your disappointment you find little else than pure sand; and the more carefully you follow the instructions in the books about washing the salt out and drying the material before "floating," the more tenaciously do these sand particles cling to the surface. The writers all ignore the fact that small bodies, such as needles or microscopical cover-glasses, though themselves heavier than water, can be easily made to float on its surface, being held up by "capillarity" or "surface tension"; and in the case of small sand-grains there is the greatest difficulty in making them sink. Unless all the particles of material are made to get wetted all over, it is useless to attempt to remove sand by "floating."

I have partially succeeded in avoiding this floating sand-film by introducing the material into the water through a piece of paper folded into a conical funnel with its opening held below the water, and finally closing the opening and removing the funnel with any particles of sand that might be floating inside. By stirring the sand in the water a number of tiny white particles rose to the surface, and by skimming these off, I did actually get a very small pinch of nearly, but not quite, pure Foraminifera in one case. Even here difficulties arise, as the sand has a most unpleasant habit of carrying down bubbles of air, and when these come to the surface and burst, they will bring up a film of floating sand. To make matters worse, bubbles of air very often form in the water itself, round the sides and at the bottom of the water, and these too rise and bring up sand with them. By the time all these difficulties have been got over it is small wonder that many of the Foraminifera have filled with water and sunk.

If it is so difficult to get pure Foraminifera on to the top of the water, it is much easier to effect a partial separation and bring them to the top of the sand, by imitating as far as possible the action of the waves in depositing those white ridges of Foraminifera and broken shells so familiar about high-water mark on our coasts. This takes far less time to do, as the preliminary washing and drying are avoided. By shaking the material in water in a saucer or soup plate, the Foraminifera and broken shells come to the top, and a gentle rotation—especially if too much water is avoided—will collect most of them round the edges, where they can be removed with a brush. If wished, it might be worth while to dry and attempt to float the material thus obtained, which would be more likely to succeed than treating the sand in bulk. As, however, the foreign matter will consist largely of broken fragments of shells and débris generally, while rounded sand-grains will almost entirely be left behind, it may be well to try the following plan, which I have not seen previously described, and which in several cases where I have tried it has answered very well.

Take a sheet of paper and, after turning over one of its edges, lay it on a flat board or book. In the "gutter" formed by the turned-over edge place a narrow line of the dried foraminiferous material and tilt the whole at a small angle to the horizon, the line of material being at the top. By getting this "inclined plane" at a suitable slope, which can easily be done by gradually inclining it till the required effect takes place, and gently tapping it, the débris will *slide* down in small jerks a little distance with each tap, but the rounded Foraminifera will be set *rolling* and will skip completely off the sheet, when they can be caught in a paper tray placed below for their reception. When the débris have nearly reached the bottom edge of the sheet they are to be tilted back into the groove at the top, and the process repeated till practically the whole of the Foraminifera have rolled off. This operation, depending as it does on the simple principle that a rounded body will roll down an inclined plane which is too rough to allow a flat body to slide down it, is very easy to carry out, and does not occupy one-tenth of the time required for the tedious process of floating. It has, moreover, the advantage that those troublesome dust filaments and wood chips are entirely left behind, as also are fragments of seaweed, zoophyte, etc. Even a small pinch of material that has been "floated" will yield far cleaner slides after being treated by the "inclined plane" method.

University College of North Wales, Bangor.

A NATURALIST IN SOUTH-EASTERN EUROPE.

By Malcolm Burr, F.E.S., F.Z.S.

DURING the past summer I had the opportunity of visiting some unfrequented portions of South-Eastern Europe. My object was to collect and study in a living state species of Orthoptera which occur in that region. During much of the time I travelled alone, but in addition to the pleasures of collecting over new ground and examining strange and somewhat out-of-the-way places there was the very interesting satisfaction of making the personal acquaintance of several eminent entomologists, with some of whom I had previously had correspondence.

During a short stay at Vienna on the way out, I had the honour of spending the day with Herr Hofrath Dr. Carl Brunner von Wattenwyl. We chatted a whole day on congenial subjects, and the veteran entomologist gave many interesting reminiscences of the older natural-history authors. He showed photographs of nearly every one who had contributed to the literature of Orthoptera, the order in which we were both chiefly interested. After a most charming day I took leave of the illustrious orthopterist, and proceeded the following afternoon to Budapest.

Here I seized the opportunity of giving myself the gratification of calling upon Herr Horváth at the National Museum. Unfortunately I was too pressed for time to be able to see the Museum thoroughly, but I was struck by some fine collections of various orders from New Guinea, as yet not worked out. Hearing that I wanted to make a collecting excursion in the neighbourhood of Budapest, the eminent rhynchotist introduced me to Herr Pavel, an assistant at the Museum, who, like Herr Horváth, is a Magyar. So the following morning, June 28th last, Herr Pavel and I started for Wolfsthal, a hill outside the town. The season was yet too young for perfect Orthoptera, but insects of other orders were swarming with many other animals. Lizards in countless numbers scuttled away from the path as we walked along. The butterfly *Argynnis latona* was common, and we took *Thecla spini*, various species of blues, *Papilio machaon*, *Zygaena carniolica*, and several species of *Melitaea*, *Syntomis*, *Ino*, and others. Coleoptera were also numerous, and we saw very many that Herr Pavel told me did not occur in Britain. The beautiful *Cetonia aurata* was common, and another species of the same genus, much more soberly coloured, was sitting in numbers on every tall plant. A small *Cicada* was stridulating in many directions, and we took some fine Pentatomidae. The heat was terrific, and we could get nothing to quench our thirst. Herr Pavel seemed to revel in the heat, but I was not yet inured to it, and consequently suffered considerable inconvenience. Eventually we came to a kaféhasz, or café, where we partook of a frugal lunch, and then walked on to the barren-looking hill of Adlerberg. There, at almost the first sweep of the net, I took *Saga serrata*. This is the only living specimen I have ever seen of this magnificent grasshopper, but it was unfortunately not yet mature. We also took *Decticus verrucivorus*, very commonly, and *Celes variabilis* Pall. It was very tantalising not to find anything but immature Orthoptera, but it was too early in the season. There we found nymphs of *Leptophyes*, *Barbitistes*, *Locusta cantans* and others, the imagines of which would have been very welcome.

An untimely accident then unfortunately confined me to my bed for ten days; but, though naturally a dreary time, when I began collecting again I found the season much more advanced.

At length, on July 9th, I left Budapest and arrived the following evening at Bucarest. It was an interesting if somewhat long journey. In the undulating country of south-eastern Hungary were large numbers of native cattle, beautiful great white beasts, with very long and gracefully curved horns. I was surprised to see also many buffaloes harnessed to wagons and carts. Among birds I noticed *Ciconia alba*, *Pica caudata* (in great numbers), *Corvus cornix*, *C. frugeligus*, *Falco tinnunculus*, or some other hawk very much like it, *Lanius collurio*, and various small birds that I could not recognize from the train. We reached the grand country of Transylvania in the evening, and the scenery was very beautiful. The locality looked rich in insects, and I yearned to get out at each little station to try and do some hurried collecting, but never had time. About dusk we entered the long and dreary plains of Wallachia, and about ten arrived at Bucarest, where I was met at the station by M. Montandon, with whom I had had correspondence for some time. He insisted on my stopping at his house, and I was only too delighted to accept his kind invitation.

The following morning, July 11th, M. Montandon took me to some rough fields and a considerable pool on the east of the town, where we saw the poorer part of the population bathing *en famille*. Fathers and mothers, children and friends, dogs and horses, were all bathing together. Round the borders of this pond we took several species of *Stenobothrus*, *Oedaleus nigrofasciatus* De G., *Truxalis nasuta* L. as larvae, *Acrotylus insubricus*, *Oedipoda caerulescens*, *Stauronotus brevicollis* Eversm, *Platycleis grisea* Fabr., *Caloptenus italicus* L., and one specimen

of that magnificent Hymenopteron, *Scolia quadrimaculata*. Great numbers of white storks were standing all round the pool, and there were others of these birds flying about overhead.

Our next excursion was to Comana. This is a wooded hill due south of Bucarest, about half-an-hour away by train on the Bucarest-Giurgevo Railway. Here the insect fauna was quite different, extremely rich, and the specimens were more mature. One little corner seemed literally alive with insects. A sweep of the net brought in several specimens of *Poecilimon*, *Isophya*, *Chrysochraon*, *Podisma*, *Leptophyes albovittata*, and various species of *Stenobothrus*. *Cicada* were chirping all round, as were also tree frogs. Large numbers of butterflies, such as *Melanargia* and *Papilio podalirius*, were fluttering about. Many Coleoptera and Hemiptera were taken, but the crowning capture was a fine female *Onconotus servillei* Serv. This is a curious Locustid, closely allied to our English *Locusta viridissima*, but quite unlike it in appearance. It is a thick-set insect, nearly black in colour, with a very large pronotum, fringed behind, and flattened from above. The whole creature looks very oriental and extra-European.

A further walk through the woods brought *Tettix bipunctatus*, *T. subulatus*, *Thamnotrizon cinereus*, *T. littoralis*, *Stenobothrus parallelus* and *Podisma alpinum* var. *collinum*. The previous year, in this very locality, M. Montandon had taken two species of Orthoptera new to science, one of which, *Callimenus montandoni* Burr, we especially sought, but in vain. This is a great, ungainly, clumsy, black, shining Locustid, as large as a good-sized mouse, and about the same shape. This day's collecting at Comana was perhaps the best day's entomological work I have ever done in my life. Hunting in a neglected district in a foreign land, in beautiful weather, in a very rich locality, with an eminent entomologist and charming companion—what more could one desire? It was here also that we took *Ascalaphus kolyvanensis*, a species of eastern Europe and western Asia, and also the rare and curious *Bittacus hageni*, that looks like a daddy-longlegs, but is really a *Panorpid*.

The collecting at Comana was so good that I feared any other locality would afterwards seem dull, but Bufta, a little village due north of Bucarest, was not disappointing. There, in a great bed of thistles, we took four males of *Onconotus servillei*, stalking them down by their chirping. Though they are in appearance so unlike their first cousins, *Locusta*, the chirp is almost identical. At the same time we took also *Celes variabilis* Pall, and *Platycleis vittata* Charp.

This was the last excursion that M. Montandon and myself took together, for on the following evening I left Bucarest. The Roumanian capital is rather a disappointing town. It is not oriental, nor yet quite occidental. A few Turks are to be seen about, but most of the natives look like gipsies: their costumes are picturesque and they are fond of bright colours. When spoken, the Roumanian language is very like Italian, and one can often gather the drift of the conversation without actually knowing a word of the language. There are naturally a good many Slavonic and Turkish words interspersed.

I arrived at Orsova at three o'clock on the morning of July 16th, and promptly went to sleep for a few hours. About nine o'clock I shouldered my net and went for half-a-day's collecting. Orsova, famous for its caviare, is just above the Iron Gates, and situated exactly on the corner of the Danube where Hungary, Serbia and Roumania join. Roumania was across the river, but I am not yet certain whether the insects that I took that day are from Serbia or Hungary. To get out of the difficulty I label them "Orsova," which is near enough.

Returning very thirsty I halted for refreshment at a little cottage with the sign "Bor, Sör" in Hungarian, that is to say, wine and beer. I asked in vain, in my best Magyar, for a glass of beer, about the only words I knew of the tongue; but though I had been understood at Budapest, English would have been here just as useful. It turned out that the mother tongue of these villagers was Roumanian, though much Serbian was spoken. As a matter of fact, of the whole population of Hungary, barely more than half are Magyar. The remainder are mixed Slav races, with a large quantity of Roumanians and some Saxons. Nearly all speak several languages, and a porter at the station at Orsova knew Magyar, German, Roumanian and Serbian equally well. Imagine an English railway porter speaking four tongues, and each of a different group of languages.

The locality seemed good, but the season was not so advanced as near Bucarest. The only species of Orthoptera that I took for the first time that day were *Sphingonotus caerulans* L. and *Gryllotalpa gryllotalpa* L. It is a hilly region, and the hills are very dry, but in some places thickly wooded. I saw a great purple-heron (*Ardea purpurea* L.), and in a clearing in a wood, at quite close quarters, I watched a hoopoe (*Upupa epops*), the scene resembling the plate of this beautiful bird in the "Royal Natural History."

At two in the afternoon I started on a weary train journey for Bosna Brod, on the way to Sarajevo, the capital of Bosnia, After twelve hours the train reached Szegedin. An hour's wait, then half-an-hour in the train, then another change, again another change and wait, at last, at midday Sunday, I arrived at Slavish Brod, drove across the Save to Bosna Brod, and found myself in Bosnia.

(*To be continued.*)

EVOLUTION BY DISCONTINUOUS VARIATION.

By G. W. Bulman, M.A., B.Sc.

MR. Bateson is one of the many evolutionists who, having weighed the theory of natural selection as propounded by Darwin and found it wanting, have proposed various amendments and improvements. Like others who have felt the difficulties of natural selection, Mr. Bateson has preferred to try and put a patch on the old view rather than discard it, or propose one entirely new. The reason of this probably is that, in the present temper of biological science, only those who retain at least the old name can hope for a hearing. In effect, each one seems to say, as he removes this or that supporting pillar of the Darwinian scheme: "We have taken away this support, but we have inserted in its place a very strong prop. The building stands as firmly as ever." The patched garment, they profess, is quite as good as the original.

The peculiar difficulties felt by Mr. Bateson may be expressed briefly as follows. Species as we see them in nature are discontinuous, that is there is an absence of graduated series of connecting links between them. Now, says Mr. Bateson, the surrounding conditions to which these species have adapted themselves are continuous, therefore, according to the theory of natural selection, the species should be continuous also. Again, the old familiar difficulty so often urged and so often replied to—the difficulty of conceiving how any character in the initial state of some minute variation can be of any advantage in the struggle for life and so be preserved, is once more brought into prominence. In these again, like other objectors in their special objections, our author carries us with him. It is ground we have already gone over for ourselves.

Referring to the usual methods of investigating biological problems on the theory of descent, Mr. Bateson is emphatic as to their unsoundness: "In these discussions we are continually stopped by such phrases as, 'If such and such a variation took place and was favourable'; or, 'We may easily suppose circumstances in which such a variation, if it occurred, might be beneficial,' and the like. The whole argument is based on such assumptions as these, assumptions which, were they found in the arguments of Paley or of Butler we could not too scornfully ridicule." No one who has studied the literature of evolution with an unprejudiced mind, and is familiar with the genealogical tree, and accounts of how various particular animals have been evolved, will think that this is putting it too strongly.

The difficulty felt by Mr. Bateson, of discontinuity of species in spite of continuity of environment, and supposed derivation from continuous variation, is more familiar to us under the title of absence of connecting links. We have all heard frequently the ingenious explanations put forward to meet this difficulty. But we agree with Mr. Bateson's contention, that though "explained," this difficulty has not been met. Possibly those who have explained it have convinced themselves—though this is perhaps doubtful, for the elasticity of the scientific conscience is great, and the scientific digestion for crude theory is as that of the ostrich—but they have convinced no impartial critic.

The same difficulty occurs in equal force with regard to the past; the numerous intermediate gradations required by the theory are wanting in the geological record. It will, however, be urged: has not Darwin explained this by showing the imperfection of this record? Darwin certainly has shown that the record is extremely imperfect, and most geologists agree with him; but is this enough? Can the record be imperfect only in one way? Or will any sort of imperfection explain the absence of continuity? We think a similar mistake has been made here as in the Darwinian explanation of the struggle for existence. Thus the severity of the struggle, the percentage killed off, is dwelt upon as if that were sufficient, irrespective of the nature of the same, to preserve slight favourable variations. Yet, as the struggle might be ten-fold more severe than it has been shown to be, and yet have no tendency to preserve slight differences, so the geological record might be equally more imperfect than even Darwin has proved it, and yet give clear evidence of continuous evolution if such had taken place. What, then, is the nature of the imperfection of the geological record? In an incomplete historical record there might be a continuous and minute narrative of a particular period or course of events, with blanks or gaps relating to others. We do not expect in a mutilated written record to find every alternate page torn out, or every alternate line obliterated. Yet this is something like what Darwin demanded in the geological record: only such an assumption prevents the facts from clashing with his views.

Why should the record be imperfect in this way? Studying the nature of the geological process by which the record is written we should rather expect to find it continuous in certain places, with great gaps in others. Thus a river carrying down its sediments to the sea along with

remains of plants and animals does so continuously, while species are changing as well as when they are in a state of stability. The ancient oceans in which were laid down certain strata of the geological series lasted long enough to record the change of many species, as indeed they do, but as discontinuous; and to account for the want of continuity we must bring in some supposition of the following nature. Either the species migrated, and were changed elsewhere where no deposition was taking place, coming back as a new species; or else we must suppose that the old species simply died out, and new ones manufactured elsewhere stepped in. Such suppositions we commend to those who desire to take them.

Like the various other objections brought forward against the original theory of natural selection by modern amenders of the same, this lack of continuity has been urged also by critics of Darwinism from the first. Like the others again, it has been replied to by those holding briefs for the older view, in spite of the fact that they themselves may have set forth equally formidable objections and difficulties. If we look back for a moment to Professor F. Jenkins' able criticism of Darwinism, we will find that he urged the very objections recently brought forward by Dr. Romanes, Mr. Bateson, Professor Eimer, and others.

Mr. Bateson tells us how these difficulties arose, and confronted him while he was engaged in the fascinating work of investigating the anatomy and development of *Balanoglossus*. Now it is said of golf that the man who once gives himself up to it is quickly lost to all sense of duty; the ties of home and kindred are as nothing in comparison with his beloved game. So it may be believed that the potent charm of tracing the development of any organism, fitting it with a pedigree, and adding another tree to the genealogical forest which forms the playground of the modern naturalist, paralyzes the scientific conscience. Those who indulge in it are lost to reason and common-sense, and revel in the wildest and most fantastic assumptions. How, then, has Mr. Bateson, a modern Ulysses, had the courage and strength of mind to bind himself to the mast of reason and common-sense and shut his ears to the sweet songs of the syrens singing of animal pedigrees, while his fellow naturalists were leaping on all sides into the sea of speculation? How has he escaped the almost universal desire to join the Zoological Heralds' College and help to fit the animal creation with pedigrees and coats of arms? Has his firm stand been the result of an early saturation with the principles of Euclid? For it seems to us that only when the imagination has been nurtured on the spare and meagre diet of Euclid, trigonometry and the calculus, is it able to resist the allurements of speculation and bind itself to the stern requirements of fact. Above all, when pasturing in the luxuriant fields of zoology does it grow wanton and indulge in wild guesses. Mr. Bateson has refused to listen to the voice of the charmer, and only fitted *Balanoglossus* with a pedigree, which he now discards, under protest. But, alas! in spite of such heroic conduct, our author has not been able to resist the temptation of proposing a theory of his own. The mathematical or logical bent of his intellect has carried him thus far on a sea of glory, but now has left him to the mercy of the critic.

Like the rest of the vendors of new lamps for old, Mr. Bateson seems to wish to make it appear that he has not really departed from Darwinism—or at least to minimise the extent of his departure. Thus he writes concerning natural selection as follows: "In the view of the phenomena of variation here outlined, there is nothing which is in any way opposed to the theory of the origin of species 'by means of natural selection, or the preservation of favoured races in the struggle for life.' But by a full and unwavering belief in the doctrine as originally expressed, we shall in no way be committed to representations of that doctrine made by those who have come after." Yet certain statements seem to imply Mr. Bateson's belief that some species, at least, have arisen without natural selection. The whole *motif* of the book, indeed, seems to be the suggestion that species may have so originated. Yet we must do the author the justice to state that he propounds no definite theory. Nor does he definitely state whether he believes discontinuous variations can lead to the differentiation of new species without the aid of natural selection, or whether such varieties must be preserved in the struggle for life just as the continuous variations of Darwin and others must be.

Again, like the rest of the objectors, Mr. Bateson is infinitely more successful in finding the holes which are sinking the barque of natural selection than in his attempts at caulking them. We perforce agree with him when he points out the inconsistency of discontinuity of species existing at present, and a belief in their continuous origin, and when he emphasises the difficulty of supposing that minute variations can be preserved by natural selection, all the more readily because we have felt the difficulties before. But when it comes to the reconstructive parts, when we are asked to believe that new species can be made out of varieties which we have been taught to look upon as freaks and monstrosities, we pause and draw back. We cannot conceive how it can be done, nor does Mr. Bateson help us by suggesting any *modus operandi*. His position seems to be: you have discontinuous variation, this must be in some way the origin of discontinuous

species; but like the French queen in another connection, *nous ne voyons pas la nécessité.*

If we are ever to arrive at a plausible theory of evolution by natural selection, Mr. Bateson thinks it will be by the study of variation: "Of this one thing there is no doubt, that if the problem of species is to be solved at all, it must be by the study of variation."

What constitutes the chief point in Mr. Bateson's divergent views is that the variations out of which new species are made are not those small variations required by Darwin and others, but what he calls discontinuous variations. That is to say, variations which appear suddenly and perfect, though not necessarily large in amount, instead of being connected by insensible gradations with the normal type. Such variations are usually looked upon as freaks, monstrosities, or abnormalities, and have been usually, we believe indeed universally, rejected by evolutionists as having taken no part in the origin of species. Mr. Bateson shows by a very large collection of examples that such variations are exceedingly common. Among these such monstrosities as extra fingers and toes in man, extra digits in animals, extra wings in insects, and such like, figure largely. We suppose that it is out of these that Mr. Bateson would manufacture his new species; but when we ask for evidence of the possibility, or probability, of this taking place, or for details of the supposed *modus operandi*, we are met by the same ominous silence which hangs over the crucial points in other theories of evolution by natural selection. The same cloud rests over the place where the big step has to be taken. Faith is required, and our guides invite us to take their hands and step on. With plausible words, scientific platitudes, and occult allusions to the mysteries of nature, they fan the wound which their want of logic is making in the mind of the reader, who, weakened by the loss of intellectual blood, is presently invited to observe that the difficulty is past.

Mr. Bateson, however, is properly modest as to what he has shown: "But, as often happens, that which may not show the right road is enough to show that the way taken has been wrong, and so it is with this evidence." This is true; only many of us saw it very clearly without this evidence, and perhaps see it no more clearly for its assistance. Indeed, with the substitution of "does" for "may," the above describes exactly the result arrived at by all amenders of the theory of natural selection as held by Darwin. Their united testimony, indeed, is strong, for they are unanimous in declaring that the wrong road has been taken, while they all point to different directions as the right one.

Mr. Bateson seems to strike the keynote of the matter when he says of the difficulties besetting the usual conception of evolution by the selection of minute variations: "These difficulties have oppressed all those who have thought upon these matters for themselves, and they have caused some anxiety even to the faithful. And if in the face of the difficulties reasonable men have still held on, it has not been that the obstacles were unseen, but rather that they have hoped a way through them would be found." Or else, we may add, they have, like Weismann, adhered to the old view in spite of the overwhelming difficulties which they have keenly felt, because the only alternative is the origin of species by design.

Surely, however, Mr. Bateson misunderstands the case when he says: "For, since all the difficulties grew out of the assumption that the course of variation is continuous, with evidence that variation may be discontinuous, for the present at least the course is clear again."

Darwin and Wallace did not suppose that species arose from continuous variation because they were unacquainted with the discontinuous form brough forward by Mr. Bateson. They deliberately chose the former as presenting the fewest difficulties, and as most consistent with their general theory. Sudden variations, indeed, are a special difficulty from certain points of views. It required the exceedingly minute variations which Darwin assumed to be able to meet the objection, that in all historical time no change of species has taken place, with the usual reply, "there has not been time." When Mr. Wallace showed, as he thought, that variation is much greater than even Darwin supposed, he increased one difficulty in smoothing away another. If we are to accept the still larger variations of Mr. Bateson, this special difficulty will be further increased. Indeed, the removal of any difficulty in this difficult theory seems ever to render another more prominent.

Again, the assertion that all difficulties grew out of the assumption that the course of variation is continuous can scarcely be upheld. For one great difficulty, perhaps the greatest difficulty the theory has had to encounter, is that of the requisite isolation of the incipient species. Another is the continued existence of low and undeveloped forms of life, which, if variation and natural selection were a *vera causa*, should long ago have attained higher rank in the zoological scale. This difficulty can only be met by the assumption of spontaneous generation, which modern naturalists are loath to admit, though some—we may quote Haeckel and Weismann as examples—perceive that it is a logical necessity.

Now, neither of these difficulties can be said to have grown out of the above assumption: all the difficulties felt by Mr. Bateson may have arisen thus, but not all those felt by others. The one thing clearly indicated by the facts is, Mr. Bateson thinks, "that the discontinuity of species results

from the discontinuity of variation." Yet in what way? Mr. Bateson still professes to believe in the origin of species through natural selection; so we must suppose it is by the preservation of such sudden, or discontinuous, variations in the struggle for existence. He wisely goes into no detail as to how this can happen, or how the isolation of a new species is more probable on this view than on that of small variations. Neither does Mr. Bateson appear to believe in the swamping effects of intercrossing, which, according to others, is one of the greatest difficulties: "An error more far-reaching and mischievous," he writes, "is the doctrine that a new variation must immediately be swamped, if I may use the term that authors have thought fit to employ."

We may note here some eminent evolutionists who have expressed their adherence to this so-called mischievous and far-reaching error. Darwin himself has admitted the swamping effects of intercrossing: "It would clearly be advantageous to two varieties or incipient species, if they could be kept from blending." Wallace has done the same. Only under certain conditions do these authors believe that this swamping effect can be overcome and new species formed. Romanes believed that only under the influence of physiological selection, or some other form of isolation, can an incipient species be preserved. Weismann, again, considers swamping to be the usual fate of varieties when natural selection does not *pick them out*, to use the current misleading phraseology. To these evolutionists, then, Mr. Bateson ascribes a far-reaching and mischievous error. The hit at the inventor of Panmixia is, however, perhaps deserved, at any rate as regards the language: "We may doubt, indeed, whether the ideas associated with that flower of speech, 'Panmixia,' are not as false to the laws of life as the word is to the laws of language." But what does Mr. Bateson say to the answer we receive when we interrogate the breeder and nurseryman on this point? What happens when the different varieties of our domestic breeds are not carefully kept from breeding with each other? Do they keep their distinctive characters when artificial selection and isolation are remitted? Why does the gardener require to keep his choice varieties out of the reach of the pollen of every other variety? What is the result if the various species of cabbage are allowed to seed together in the same garden? We cannot complain that the answer to these questions is at all an uncertain one. The testimony is unanimous that any variety will be swamped, or, if the term swamped be objected to, we will say lost, if allowed to breed freely with others.

We must confess, again, that Mr. Bateson seems to misrepresent the upholders of natural selection when he asserts that "the belief that all distinctness is due to natural selection, and the expectation that apart from natural selection there would be a general level of confusion, agrees ill with the facts of variation." For surely it would be more accurate to say, "apart from natural selection there would be a general level of *uniformity*"—a few simple species, one species, or none at all, according as we suppose there was one primary form of life created, or several, as Darwin suggested; or, pushing the matter further, assume that the first species was the result of natural selection on dead matter. Mr. Bateson himself, as a believer in natural selection, must attribute some of the distinctness of species to it; but how much? Does he, we ask, believe that sufficient distinctness to constitute species may exist without it? If so, natural selection is not required in the origin of species, that is to say, not in the origin of all species. On this question Mr. Bateson seems undecided, whilst apparently wishing to retain natural selection with one hand, to give it up with the other.

Thus, like the Cæsars who have done so before him, Mr. Bateson as Brutus has shown that he also can call forth spirits of difficulty from the vasty deeps of the theory of natural selection. He has, in my judgment, failed to show that he can disperse them when they come—as they freely do, at his call—by waving over them his wand of Discontinuous Variation. Along with those called forth by other biological conjurers they stand in serried ranks, a great army ready to devour the last remnant of faith in a great theory.

29, Queen's Terrace,
Jesmond, Newcastle-on-Tyne.

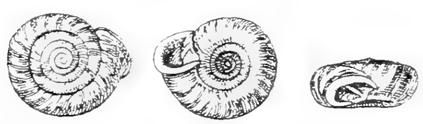
INDIAN PLAGUE IN EUROPE.—For more than a year past, at the pathological institute attached to the Central Hospital of Vienna, Professor Weichselbaum and his assistants have been investigating the Asiatic disease known as bubonic plague. These experiments have been conducted with extreme care by those engaged upon them, in case any of the bacilli of the disease should spread beyond the precincts of the special laboratory where the research was conducted. The staff employed consisted of the Professor and Dr. Albrecht, with one other assistant, both of whom have been in India engaged on these investigations. One other person only was admitted to the rooms—an attendant, named Barisch. On being appointed, some fifteen months ago, Barisch was asked if he would be inoculated for the plague, but thought there was no need. He had always proved thoroughly trustworthy, and was latterly treated by the staff rather as an assistant than an attendant. Recently Barisch had occasionally returned home late at night slightly intoxicated. This affected his faculties, and he became careless in his work. On Saturday, October 15th, Barisch seemed to be ill, and it was thought he suffered from influenza, but by Tuesday, the 18th, the disease was found to be plague, and he died that evening. His nurses were isolated, but one of them and Dr. Müller, who attended him, have contracted the disease, and the latter has also died.

ARMATURE OF HELICOID LANDSHELLS
AND NEW FORMS OF PLECTOPYLIS.

By G. K. Gude, F.Z.S.

(*Continued from page* 135.)

PLECTOPYLIS linterae (figs. 88*a-c*), from Pegu, was described by Dr. von Möllendorff in the "Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft," 1897, p. 28. The shell is sinistral, solid, discoid, widely umbilicated, pale yellow, transversely streaked and flammulated with chestnut, finely and regularly ribbed, smoother below, decussated with microscopic spiral lines. The spire is slightly conical, the apex scarcely produced, and the suture linear. There are six whorls which increase slowly and regularly, and are a little flattened above and rounded below; the last is slightly angulated above the periphery

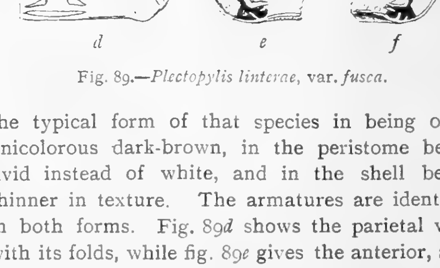


a b c

Fig. 88.—*Plectopylis linterae.*

and around the umbilicus, and descends rather abruptly and deeply in front. The aperture is oblique, heart-shaped. The peristome is white, thickened and strongly reflexed; its margins are united by a strong flexuous raised ridge on the parietal callus. The parietal armature is composed of a slight median horizontal fold, which proceeds from the apertural ridge, is interrupted for a short distance and then continues parallel with the suture for about a quarter of the last whorl; it then gives off a shortly descending, slightly reflexed arm, which is provided anteriorly at the lower extremity with a short horizontal ridge; the fold then rises obliquely for a short distance and finally bifurcates; *the lower arm of the bifurcation is the longer*, and descends obliquely, its lower extremity being provided posteriorly with a short horizontal ridge; the upper arm at first continues to ascend obliquely, then deflects horizontally close to the suture; a short, free, thin, horizontal fold occurs below the two lower arms, not extending beyond on either side (see fig. 89*d*, which shows the parietal wall with its folds). The palatal armature consists of: first, a thin long horizontal fold near the suture and parallel with it; secondly, a shorter but stronger broad horizontal fold, which deflects a little and is slightly indented posteriorly; thirdly a still shorter, broad, straight horizontal fold; fourthly, a strong broad vertical plate, which intercalates between the two lower arms of the parietal fold; this plate is inclined towards the aperture, and its edge is thickened and reflexed; near its lower extremity on the posterior side occurs a strong little denticle, which is elongated horizontally; fifthly, a short thin horizontal fold close to the lower suture, having an elongated denticle a little above its posterior extremity. The species is closely allied to *Plectopylis achatina*, but the spire of the present shell is much more raised, the umbilicus is much deeper, and the whorls more rounded. In the armature this species further differs from *P. achatina* in the median parietal fold being interrupted and much slighter, the branched portion being relatively much more elevated; the lower free horizontal parietal fold is very short, so that this part of the armature, while differing from the typical forms of *P. achatina*, recalls the condition which obtains in the var. *breviplica* of that species. The specimen figured, which I received from Miss Linter, was labelled with the habitat, "Moulmain." It measures: major diameter, 16 millimetres; minor diameter, 13 millimetres; altitude, 6 millimetres.

Plectopylis linterae var. *fusca* (1) (figs. 89*a-f*). Mr. Ponsonby possesses a shell labelled *P. pachystoma* var. *minor*, which I am unable to separate specifically from *P. linterae*, but which differs from



a b c d e f

Fig. 89.—*Plectopylis linterae*, var. *fusca*.

the typical form of that species in being of a unicolorous dark-brown, in the peristome being livid instead of white, and in the shell being thinner in texture. The armatures are identical in both forms. Fig. 89*d* shows the parietal wall with its folds, while fig. 89*e* gives the anterior, and

(1) *Plectopylis linterae* var. *fusca*, n. var. (figs. 89*a-f*), differs from the type in being unicolorous dark-brown, a little paler below, in being thinner in texture, and in the peristome being livid. Major diameter, 14·5 millimetres; minor diameter, 12·5 millimetres; altitude, 5·5 millimetres.—Habitat, Burma.—Type in Mr. Ponsonby's collection

89*f* the posterior aspect of both armatures; all three figures are enlarged. Figs. 89*a-c* show the entire shell in three different views, all of natural size.

Plectopylis cairnsi [2] (figs. 90*a-g*). I base this new species upon a single unnamed specimen received by me from Mr. Robert Cairns, to whom it was sent

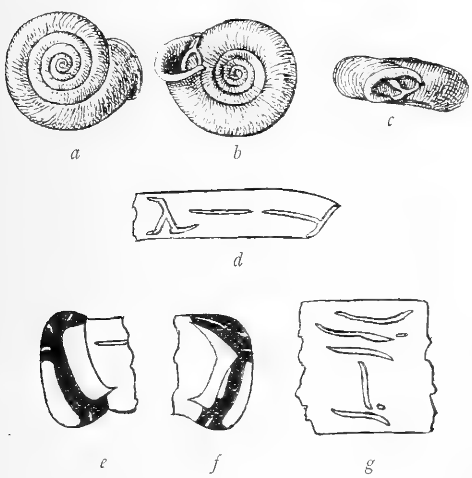


Fig. 90.—*Plectopylis cairnsi.*

by a correspondent in Singapore. Nothing is known of its origin, but the shell, which is somewhat decorticated, appears to have come in contact with red colouring matter, so that it is not improbable it was imported with dye material from Burma, which country, judging from the characters of the shell, may reasonably be supposed to be its native place. At first I was inclined to refer the specimen to *Plectopylis achatina*, but its more rounded contour led me to suspect that it was an undescribed form, and this suspicion was confirmed on my opening the shell, for I then found the armature to constitute a connecting link between that of the groups of *P. achatina* and *P. ponsonbyi.* I have much pleasure in dedicating this new species to Mr. Cairns, who was kind enough to allow the specimen to pass into my collection. *P. cairnsi* is flatter and more rounded in outline than *P. achatina;* the whorls are more rounded and not angulated, the last whorl widens less at the aperture, the suture is more impressed, the umbilicus less deep, and the peristome is white. The parietal armature differs from that of *P. achatina* and its allies in the median fold being interrupted in the middle and separated from the branched portion which is in the form of the Greek letter λ, and in the total absence of the horizontal fold near the lower suture (see fig. 90*d*, enlarged, which shows the parietal wall with its folds). In the palatal armature there are also some minor differences: the first horizontal fold is indented opposite the upper arm of the branched parietal fold, a feature I have not observed in any other species; the vertical plate is also much narrower than in *P. achatina,* leaving more space for the soft parts of the animal to emerge (see fig. 90*e*, which shows both armatures from the anterior side, and fig. 90*f*, from the posterior side, both enlarged); and, finally, the denticle behind the fifth horizontal fold, present in every other known species of the group of *P. achatina,* is absent (see fig. 90*g*, enlarged, which shows the inside of the outer wall with the palatal armature *in situ*).

Plectopylis (?) iamcabensis (figs. 91*a, b*), from Ceylon, was described and figured by Dr. F. Jousseaume in the "Memoires de la Société Zoologique de France," vii. (1894), p. 278, t. 4, f. 8. As I have

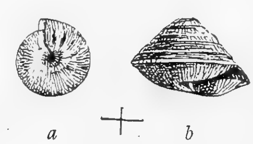


Fig. 91.—*Plectopylis* (?) *lamcabensis* (after Jousseaume).

been unable to obtain a specimen of this species, I have been compelled to rely upon Dr. Jousseaume's description, and to copy his figures of the shell. It is described as follows: shell subperforate, trochiform, stout, somewhat thin, striated and surrounded on the last whorl by three threadlike ridges, diaphanous, shining, corneous white, apex obtuse, suture impressed, crenulate; whorls seven and a-half, flattened, the last angulate, not descending; base more convex, radiately striate; aperture scarcely oblique, subangulate, lunate; peristome simple, straight, columellar margin sloping, near the umbilicus narrowly dilated. Diameter, 4 millimetres; altitude, 3 millimetres. Habitat, Nuwara,

[2] *Plectopylis cairnsi*, n. sp. (figs. 90*a-g*), shell sinistrorse, discoid, solid, widely umbilicated, yellowish corneous, finely and regularly ribbed, and decussated with microscopic spiral lines. Spire depressed, apex scarcely prominent, suture distinctly impressed; whorls five and a-half, tumid above, rounded below, increasing slowly and regularly, the last descending moderately in front; aperture oblique, cordate, a little inflexed at the upper outer margin. Peristome white, strongly thickened and reflexed; the margins united by a strong raised flexuous ridge on the parietal callus, notched at the junctions above and below. Parietal wall with a strong median fold, given off from the apertural ridge, revolving round about a quarter of the last whorl, but interrupted at the middle; near its posterior extremity occurs a branched fold in the form of the Greek letter λ, *i.e.* an obliquely ascending fold, having anteriorly at its lower extremity a slightly ascending ridge and posteriorly a short support; it is deflexed horizontally at its upper extremity, and at about its middle it gives off an obliquely descending arm, which deflects horizontally at its lower extremity. Palatal folds, five: the first, thin, horizontal, near the suture, a little indented and reflexed opposite the upper extremity of the oblique parietal fold; the second, horizontal, a little shorter and deflexed posteriorly, provided with a small denticle a little above its posterior extremity; the third, still shorter, but broader, horizontal, crescent-shaped, its concave side towards the fourth, which is vertical, very strong, inclined towards the aperture; near its lower extremity on the posterior side occurs a minute denticle; the fifth is horizontal, short and very thin.—Major diameter, 18·5 millimetres; minor diameter, 15·5 millimetres; altitude, 6 millimetres.—Habitat, probably Burma.—Type in my collection.

Eliya. No mention whatever is made of any armature, and the systematic position of the

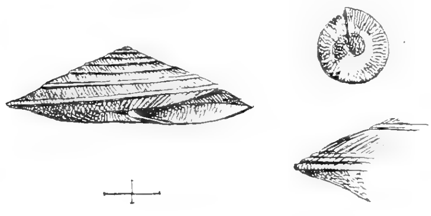


Fig. 92.—*Kaliella (?) eugenii* (after Jousseaume).

species, therefore, remains doubtful; if it really be a *Plectopylis* it will in all probability be found to belong to the section *Sykesia*. Mr. Sykes has doubtfully suggested (Proc. Malac. Soc. London, iii. (1898), p. 71) that it belongs to the genus *Sitala;* but I do not think this is probable. In the same work (p. 277, t. 4, f. 1) Dr. Jousseaume described another shell which he also places in *Plectopylis, i.e. P. eugenii*. In this case also no mention is made of armature; moreover, the figure given, which I have copied for convenient reference (see fig. 92), does not at all give the idea of a *Plectopylis*, and I agree with Mr. Sykes in thinking that it may belong to the genus *Kaliella*.

NOTE.—By an oversight fig. 78*f* on page 74 has been placed upside down.

(To be continued.)

PREPARATION OF DIATOMACEOUS MATERIALS.

By EDWARD H. ROBERTSON.

NOTWITHSTANDING all that has been written on the preparation of diatomaceous materials for microscopic purposes, it is surprising how few amateurs can deal with these materials in anything like a satisfactory manner. My present object is to give a brief outline of the methods I have myself practised for half a century, and with almost unvarying success. The following are a few of the indispensables required, both in the matter of apparatus and chemicals; they are mostly inexpensive. One Wedgwood pan, or pipkin, furnished with lid and handle (ordinary shallow evaporating pans are utterly useless for the preparation of micro-material); two or three glass beakers of about half-a-pint capacity each; a few test tubes; sundry common tumblers, or old-fashioned ale-glasses; three or four stoppered bottles, each of about one-pint capacity; a few glass slips; and two or three glass rods, from six to eight inches long, tapering to a point, and about the thickness of a common penholder. Of chemicals the following are absolutely requisite, viz: 1 lb. of common hydrochloric acid, at 3d. per lb.; 1 lb. of common sulphuric acid, at 4d. per lb.; 1 lb. of common nitric acid, at 8d. per lb.; 1 or more ounces of chlorate of potash, at 2d. per ounce; a similar quantity of bichromate of potash, at 1½d. per ounce: 7 or 8 lbs. of carbonate of soda, at 6d. per 12 lbs.; half-a-pint of liquor potassa (Brandish's solution), at 1s. per lb.; sundry quarts of distilled—not simply filtered—water, at 4d. per gallon; and the same quantity of pure rain water.

So much for the outfit of the amateur diatomist. Thus furnished he may safely tackle all but the most refractory materials with the certainty of a favourable result, always provided that he has an unlimited stock of patience. If this excellent quality be not his happy possession, then let him leave the manipulation of diatomaceous materials to those whose it is, and himself purchase slides of diatoms from some of the many first-class dealers in these objects, and—lose half the pleasure of filling his cabinet with his own mounts. If economy be a consideration, and he fertile in resource, the reader will be able to substitute even less costly apparatus for that indicated. It is astonishing what a large amount of useful work may be accomplished with the most unpromising appliances. When, a mere lad, I commenced the preparation of microscopic materials—the subject of this paper—my sole outfit was a common gallipot, a glass rod, and a few ounces of nitric acid; my laboratory the hobs of the sitting-room stove—to the great distress of the good housewife and the detriment of the fireplace and its appurtenances. Yet with these rude appliances I successfully prepared very refractory guanos, etc. I have, however, long since learned that work may be done with infinitely more comfort with proper though, perhaps, more expensive apparatus.

FOSSIL MATERIALS.

From whatever source obtained, fossil diatomaceous materials are almost invariably received by the operator in the form of lumps of rock or earth. Some, for instance the Nottingham, U.S., materials, are almost chalky in consistence, others, as that from Sendai, Japan, are of stony hardness. Hard or soft matters not, the first process must be their reduction to an impalpable powder. This must on no account be done by pounding or breaking with a hammer, which would simply mean the utter destruction of all the finer forms contained therein. Their disintegration may be

accomplished by either of the three following methods: by exposure to hard frosts; by means of the crystallization of certain chemical salts; or, by the use of mineral acids, either hydrochloric or nitric—but *not* sulphuric. In many instances the employment of hydrochloric acid will alone suffice to bring them to the desired condition; indeed, as an invariable rule this acid should, first of all, be applied to the substance to be operated upon, whether recent or fossil. This is to remove every trace of solid calcareous matter by its conversion into the very soluble chlorate of lime. If disintegration is the result of its application, then the operator's work is greatly lightened; but if, when all effervescence has ceased, the lumps remain in about the same state, after well washing to remove all traces of acid and lime, they may be submitted to the action of frost.

By this process the lumps must always be well soaked in water, then, half immersed, exposed in a saucer or other shallow vessel in some open spot until hard frozen. So soon as the contents of the vessel are thus congealed the whole may be placed in a warm situation, say, on a fireside hob or in a hot oven. Upon the melting of the ice it will immediately be seen that the lumps readily crumble with a touch. One exposure will, however, seldom suffice, and occasionally it is desirable to submit the material to the freezing and thawing process three or four times. It is evident that this plan is not generally practicable; other means must therefore be employed. This is usually done by the use of certain salts, which by their crystallization break down the hard lumps without injury to the diatoms. The chemicals mostly used are either common saltpetre, *i.e.* nitrate of potash, or Glauber's salts, *i.e.* sulphate of soda—preferably the last. These salts contain a large quantity of water of crystallization; the crystals are large and quickly formed; their action, therefore, upon the lumps submitted to them is rapid. The material must be dropped into a hot, nearly saturated solution, and should there be allowed to remain for some considerable time; if for several hours so much the better. The solution and lumps should then be set aside in a cold spot, and be undisturbed until thoroughly crystallized. Upon submitting to heat to dissolve the crystals, as in the case of frozen materials, it will be seen that the lumps have been fissured in every direction. More often than not, however, the process has to be repeated, occasionally five, six, or more times, until the disintegration is complete. This will depend upon whether or not the solution has thoroughly penetrated into the very heart of the lumps. So compact, by the enormous pressure to which they have been subjected, are the materials of some rocks that I have known lumps no larger than a small walnut to remain perfectly dry in the centre after soaking in water for many weeks. This I have proved by splitting open. Hence the frequent failure to disintegrate by two or three exposures to the crystallizing process. This once complete the solid matter should be allowed to subside. The fluid should be carefully decanted and a liberal supply of clean rain or distilled water added. After a good stir up and a few hours allowed for deposit of sediment, the water must be again poured off and this repeated so long as any taste of the chemical used remains.

Disintegration accomplished, the material—well washed—is ready for boiling, and may be transferred to the Wedgwood vessel (or beaker, if preferred, but I never use this latter vessel for sulphuric acid treatment), and allowed to settle. Then as much of the fluid as possible should be poured off, and to the residue two or three times as much sulphuric acid should be added. Immediately a violent commotion takes place, the heat generated converting a portion of the moisture in the material into steam. This action soon ceases, and the vessel may be at once placed over the lamp or stove, but must be carefully watched to see that the contents do not boil over. By degrees the ebullition ceases, the whole of the water has been expelled from the mixture, and nothing remains but the material and acid. When this point is reached the acid barely bubbles, and the whole is converted into a thick jet-black fluid, or semi-fluid, the result of the carbonization of the organic matter, dense suffocating fumes of acid being evolved. At this point chlorate of potash may be added, either in powder or in solution.

The action of the chemicals upon each other is twofold; the sulphuric acid, having a strong affinity for the potash, at once seizes upon it, and chlorine gas is liberated, this latter converting the jet-black into a snow-white fluid. The process is necessarily a slow one, for but a very small portion of either the chlorate powder or solution must be introduced at a time. If the powder be used decrepitation takes place, and the operator must be careful to avoid accidents. To begin with, let him try a pinch each time, introduced by a spoon or piece of wood. When the solution is used, much greater care must be exercised, as, apart from the chemical action, the sudden introduction of a cold solution into boiling sulphuric acid at more than 600° Fah. immediately converts the solution into steam, explosions follow, and showers of scalding particles of acid are scattered. Even when the solution is added drop by drop portions of the contents of the vessel are ejected, sometimes to long distances. I usually hold before my face a sheet of glass when operating with the solution, but would recommend the young amateur to confine himself to the use of the powder. When the

bleaching of the material has been accomplished, the vessel and its contents should be set aside to cool. On no account should cold water be allowed to come into contact with them until the temperature has fallen below the boiling-point of water, or a violent explosion will assuredly follow. It is better, when somewhat cool, to pour the contents of the vessel into another of clean rain water, and, after perfect subsidence of the solid matter, the liquid may be poured off, and a fresh portion added, and this may be repeated so long as any acid taste remains. It is desirable to get rid of this persistent acidity as soon as possible. I therefore always after one or two washings, add sundry lumps of common soda to the preparation until all effervescence ceases. Then I allow it to remain quite undisturbed until next day. Strangely enough, although the solid contents of vessel were white, and the water colourless, they will now be found, the first less white, and the latter almost black, and this effect will be the result of several repetitions of the operation.

It may be supposed that the whole process has now been completed, and occasionally such may be so; but more often than not, upon placing a portion of the preparation upon a glass slip under the microscope, it will be found that, although the individual diatoms are tolerably clean, they are so much mixed with mineral matter that the whole process must be repeated until the diatoms—clean and bright—sponge spicules and gemmules and sand alone remain.

It is almost impossible here to give instructions as to the best method of dealing with every individual case, as each material requires somewhat different treatment. It may, however, be stated that, as a rule, the foreign matter mixed with the diatoms consists of lime and its compounds, or of extremely fine particles of silicious matter. The lime may be removed either by hydrochloric acid, or by repeated washings with cold pure rain or distilled water. Lime dissolves but very sparingly in hot water, more readily in cold, and after the preparation has been allowed to stand for a day, the clear water will have become milky. This cloudy fluid must be poured off from the sediment, and clear water added, day after day, until no further cloudiness is to be observed. This is a very tedious process, and the operator will probably prefer the use of hydrochloric acid. When all has been done it is almost invariably better to give the preparation a boil with carbonate of soda. Bring it to a boil, not much more; three or four minutes will then suffice, for if longer continued the diatoms will certainly suffer. A lump of common soda about the size of a walnut will be sufficient for one pint of water if the preparation be tolerably clean, for half-a-pint if it be somewhat dirty.

(To be continued.)

CHAPTERS FOR YOUNG NATURALISTS.

THE INFINITELY LITTLE.

By J. O. Symes, M.D.

(Continued from page 141.)

COMING now to the fermentative species. The one which most readily presents itself to our notice is the yeast-germ. Yeast consists of a mass of microscopic cells, or germs, each of which has the power of converting a solution of sugar and water into alcohol. The yeast cell on gaining access to a sugary solution at once begins to digest it, and the result of that digestion is to convert the compound into alcohol. The cells when dry are cabable of being floated about in the air, and are indeed constantly present there, thus accounting for the fact that any sweet syrupy liquids left exposed soon undergo fermentation. At first it was not known which particular species of germ caused the changes just described; but when once the species had been isolated it was carefully cultivated and its energies devoted to man's use. We can now buy yeast by the ounce or pound, a curious way of retailing germs. The discovery of this alcohol-producing microbe may appear to many to have been a very doubtful benefit, and such will find some consolation in the fact that whilst there is only one known species of germ capable of making alcohol, there are many capable of spoiling it. In a recent number of a trade journal there was an article entitled, "Micro-organisms causing Diseases of Beer," and a goodly list was appended. These are the temperance reformers of the World of Germs. Chief amongst them is the acetic acid organism, whose peculiar function it is to convert alcohol into vinegar. In countries where wine is plentiful and exceedingly cheap, vinegar is made by adding this germ to the wine and allowing it to undergo acetous fermentation. In England, however, vinegar, like beer, is made from malt. Alcoholic fermentation is first excited by the addition of yeast, and then the new vinegar-producing microbe, called in the trade "rape," is introduced, and the conversion of the malt is complete. There are many other instances

in which bacteriological processes are utilised for man's service. The flavour of high game, the taste of butter, the qualities of ripened cheese, even the perfect attributes of sublime tobacco are all the result of the efforts of these microscopic creatures on our behalf.

Passing from the *fermentative* to the *putrefactive* organisms, we may say at once that the work done by these species of bacteria is of the most useful and beneficent character. That a plant cannot digest the same food as a man, or one of the lower animals, is evident to all. Yet animal food contains the elements essential to the life of the plant, arranged in a different form it is true, but the same elements. It is the work of the putrefactive organisms to break up complex bodies, such as animal or vegetable fibre, and to rearrange their constituents in such a way that they may become fit food for plants. This is the process which we call "decay." Some putrefactive germs are to be found in air and water, but these are feeble forms working with the evolution of much evil-smelling gas. The true workers of the flock are to be found in the soil, in the upper layers of which they exist in countless myriads. The arrival of dead matter in any shape or form is the signal for them to commence work. It may be a withered leaf or a dead bird—all comes alike to them. In an incredibly short space of time the material is seized upon, devoured and converted into simple chemical compounds suitable for the nourishment of vegetable life, and soon to be built up into flower, plant, shrub or tree. These germs act then as a connecting link between the animal and vegetable kingdoms, and keep up the circulation of matter from dead to living and from living to dead. By their agency the decaying offal of to-day becomes the green grass of to-morrow; which in turn is the beef, the man, and the silent dust of the future: and so the cycle is completed. The bacteria are only found in the upper layers of the soil, about the upper eighteen inches; so that things deeply buried do not get the benefit of their action. The gardener has learned this, and digs his dressing into the surface only; the ploughman makes his furrow inches, not feet, in depth.

One of the most recently discovered and most useful powers possessed by bacteria of certain forms is the conversion of sewage into harmless inoffensive mud and clear water in which fish may live. The sewage of Exeter and other towns has been so successfully dealt with on these lines that the Government recently decided to appoint a Royal Commission to enquire into the subject. The employment of bacteria promises to revolutionize this branch of sanitary work. The pollution of rivers will be a thing of the past, and an annual saving of hundreds of thousands of pounds will result throughout the world. It would be difficult to over-estimate the value of this boon conferred on man by the much despised microbe.

There is one form of earth bacillus whose action has recently been investigated. This organism is to be found in minute shining clusters on the rootlets of leguminous plants such as peas, beans and lentils. Farmers have long known that to plant two crops of wheat in the same field in successive years is to court failure, for the nutritious substances of the soil have been exhausted by the first. If, instead of wheat, the crop for the second year be beans or lentils, the soil is found to become greatly enriched, even though no manure has been added, the gain consisting principally in an increase of the amount of nitrogen present. This nitrogen could only be obtained from the air in the interstices of the soil. The agent at work is a bacillus which attaches itself to the roots of the plants I have named. It not only abstracts enough for the use of the plant, but it is able to give off the excess for the improvement of the soil, thus acting as an invaluable assistant to the farmer. As soon as this remarkable faculty became understood, the growth of the microbe became an industry, and to-day the nitrifying organism can be bought by the bottle; all that the farmer has to do is to mix them with water and sprinkle his fields. Sufficient to fertilize an acre can be bought for half-a-crown.

Phosphorescent bacilli belong essentially to the putrefactive order. They may be detected frequently on decaying fish-bones, so that these when viewed in the dark, glow like the top of a wetted lucifer match.

Not all fermentative species are as beneficent and harmless in their action as those I have mentioned. Some elaborate the most virulent poisons, as frequent cases of food poisoning testify. Of course all food contains germs. Every meal we take means the swallowing of an army of harmless forms; indeed, their presence is probably essential to proper digestion, for animals fed on sterilized food do not flourish, and, it is said, eventually die. To be told that we are breathing and eating microbes by millions need give rise to no alarm, for those that have a power for evil are comparatively few, and need special conditions for their multiplication.

Just a few words in conclusion on micro-organisms causing diseases in plants and animals. I shall touch very lightly upon this part of the subject, for, as I have said, I have no wish to lay emphasis upon what might be called the criminal classes in the World of Germs. Amateur gardeners are painfully aware how frail a thing is plant life, and with what a host of enemies it is surrounded. Not the least of these are germs of various sorts, such as Phylloxera, which has so often devastated the vines of France, or the potato germs which

bring periodic famine to our sister island. Apples, pears and all sorts of fruits have their particular microbe enemies. Even flowers are not exempt, witness a recent epidemic that destroyed one season's carnations. At first sight these parasitic visitations might seem doubtful blessings, but they serve an important purpose, namely, that of keeping the growth of vegetable life within due and proper limits. It has occasionally happened that British plants or herbs have been transferred to foreign soils and have there spread so rapidly as to supplant the indigenous species and become veritable scourges. In such cases it is probable that the controlling microbe has not been transported with the plant, which is then, as it were, a community freed from the struggle for existence, and spared the beneficent ravages of disease. On such small points as these does the balance of nature depend.

It was in connection with the diseases of animals that most of our knowledge of germ life was in the early days worked out. There are a large number of diseases both in animals and in human beings, the exciting cause of which is now known to be the multiplication of microbes within the system. Every year sees additions to this list, and our enterprising American cousins have already laid claim to the discovery of such species as the "germ of madness," and the "germ of death." A striking instance of microbial disease amongst lowly forms is the epidemic known as pebrin, which plays such havoc amongst silkworms, and which at one time threatened to extinguish the silk trade of the South of France. The cause of this disorder was first shown by Pasteur to be a minute germ which invades the moth and eggs. This having been ascertained the remedy was easy. The moth, directly it has laid its eggs, is now examined, and if the germ be detected both moth and eggs are destroyed, and thus the disease prevented from spreading.

The science of bacteriology has similarly thrown light upon a score of like diseases, chicken-cholera, splenic-fever, swine-fever, glanders, consumption, and rinderpest, diseases which sweep across a continent carrying off stock by hundreds of thousands; all these are the handiwork of creatures infinitely little, but infinitely industrious and persevering. How much of the great work of the world is done by little people. Even disease germs are not without their uses for man. It has been proposed to utilize cultures of certain species for the purpose of destroying vermin, and other pests. In Australia an effort is being made on these lines to cope with the invading hosts of rabbits; possibly the insect powders, rat poisons, etc., of the future will be of a similar nature.

We see then that germs though infinitely little are infinitely powerful, and that their action, far from being uniformly prejudicial, is to a great extent essential to man's welfare. Germs are the scavengers and fertilizers of the world; they play a great part in our industrial and domestic economy, and act as a regulating force in the animal and vegetable kingdoms. Without their help both the animal and vegetable world would cease to exist, nor would it be possible to keep the world sweet and clean. Their life-history throughout is indeed a striking illustration of the fact that the welfare of the greatest is dependent on the services of the very least.

11, *Richmond Hill, Clifton, Bristol.*

BEE-LOUSE (*Braula caeca*).

PARASITIC DIPTERON.

MR. C. J. Watkins, of Painswick, Gloucestershire, has kindly lent us a series of exquisite micro-photographs from which we have selected one for reproduction. It represents a bee-louse (*Braula caeca* Nitz, × 20). This small parasite, about one-eighteenth of an inch long, and of a rusty-brown colour, is a member of the pupiparous Diptera, which include the forest-fly (*Hippobosea equina*), the sheep-ticks (*Melophagus ovinus*), the stag-ticks (*Lipoptena cervi*), the swallow-fly (*Stenopteryx hirundinis*), the bat-louse, and other species, winged and wingless. The bee-louse is said to have a preference for the drones. It lives upon the thorax of its host, holding to the hairs by the well-adapted pectinated claws of the tarsi.

GEOLOGY FOR BEGINNERS.

AN interestingly-written book for beginners in the study of geology, and an instance of the great improvement which has taken place in such text-books during the last few years, is the new one by Professor Watts (1). It is quite original in its style of inception, and is thoroughly modern in regard to its teaching. Indeed we are inclined to think that a student who is acquainted with all the facts noted in this work will not be disposed to consider himself a beginner any longer. Geikie's "Text-Book" is beyond the reach of many pockets, so Professor Watts' "Geology" will come most opportunely. Petrology generally holds an important place, and the broad principles of geology are dealt with in an interesting and masterly manner. We should have liked to have seen more space devoted to stratigraphy, but the syllabus of the Science and Art Department forbids too much emphasis being laid on this portion of the subject. The illustrations deserve special mention, as the "Kodak" has evidently been hard at work, and with excellent results. Geological landscapes are thus produced true to nature; one of these, through the kindness of the publishers, we are able to lay before our readers. The only fault we have to find is that most of the illustrations are small, but considering the price of the book this cannot be considered a defect. Rocks, both igneous and clastic, are shown as seen under the microscope. Derivations of all technical words used are carefully explained by means of footnotes, the Greek or Latin roots being invariably given. One or two simple experiments are suggested for use by the teacher; in fact, the whole work proceeds on the supposition that wherever possible specimens are used to illustrate each lesson. We commend the useful suggestion made in the preface, that the line-drawings in certain cases should be coloured by the student to show their geological value. The chapter on fossils (xvi.) is carefully written, and should be accurately studied by beginners in the science of palaeontology. The zoological classification of fossils is plainly shown, and useful illustrations of the various classes are given. Too much importance cannot be laid upon the necessity of beginners having a clear conception of the proper method of classifying their fossils. There is also a very useful and comprehensive index of eleven pages at the end of the book. We should be interested to know where Professor Watts places the Bovey Tracey tertiary formation, as we find no reference to it. The work is one which can in every respect be heartily recommended.

E. A. M.

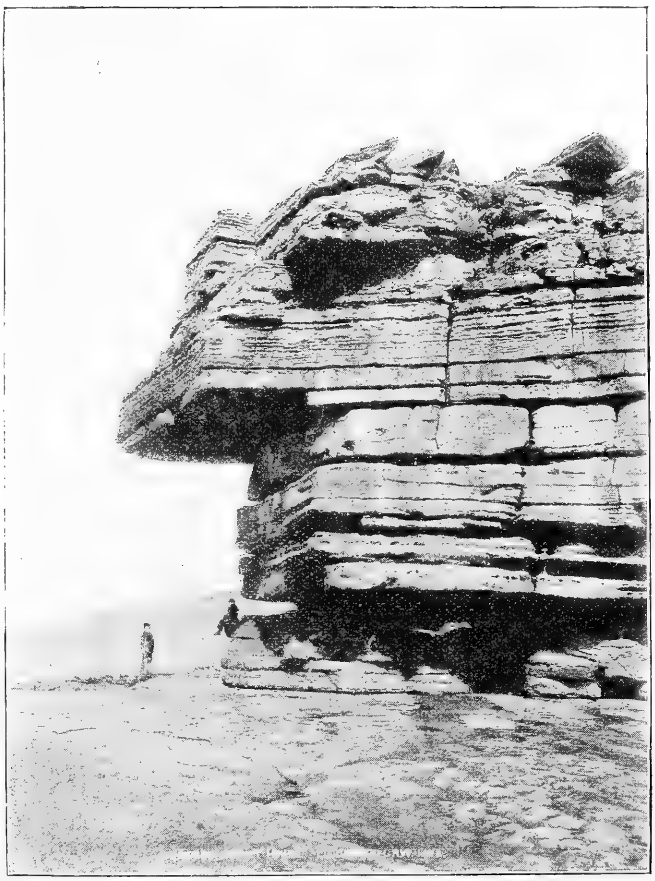


Photo by] CARBONIFEROUS STRATA, DONEGAL. [*R. Welch, Belfast.*

(1) "Geology for Beginners." By W. W. Watts, M.A., F.G.S. 351 pp. 7 in. × $4\frac{3}{4}$ in. with 310 illustrations. (London: Macmillan and Co., Ltd., 1898.) 2s. 6d.

THE AUTUMN WOODLANDS.

By Dr. P. Q. Keegan.

THERE are few spectacles in nature more impressive than the autumn woodlands. The tints or shades exhibited by the leaves are singularly varied and beautiful, when on favourable occasions they are sun-lit in a way that is most efficient in the development of their highest attractiveness. The sullen sombreness of the atmosphere, the shadowing forth, so to speak, of approaching decay, followed closely by the chilling advent of winter, is only intensified by the last fitful gleams of sunlight. Who would think that the golden and crimson glories of the autumn scene are due to the self-same or closely allied bodies that help to paint the spring and summer flowers and render them richly dight in hues and tints of azure, scarlet, purple, orange or yellow? Yet it is so. I shall endeavour in the following remarks to explain the subject.

The poets or close observers of the sylvan enchantments have recognized two phases of colour in the autumn leaves of most of our indigenous trees. Thus we have "the rowan scarlet and yellow; the broad gold pieces of the aspen; the crimson leaf hanging loose on the cherry; the jewels of gold in the hair of the birch tree; the beech leaf yellowing, the oak leaf reddening; the maple yellow-leafed." It must be understood, however, in the way of science, that as soon as the chlorophyll green has faded through incipient loss of vitality, then the leaves of our oaks, beeches, poplars, elms, ashes and others turn in the first instance to a bright yellow. This change is brilliantly exhibited, under favourable conditions, in the case of the beech, whose "lucid leaves, varying in hue from auburn to gold colour, reflect back the level rays of the descending sun and thus burn with pre-eminent lustre, like a sudden illumination." The blaze is especially lustrous in the autumn woodlands for precisely the same reason that the buttercups or other yellow and orange flowers present a brilliant, almost metallic, lustre in the lap of spring meadows. In both cases the pigment is carotin dissolved, perhaps, in the oil of the leaf, a degenerate product of the dying protoplasm. The effect is enhanced by a background of starch, which subserves the function of a reflector. Let anyone who doubts the fact extract and prepare the colouring principle of yellow petals and of autumn yellow leaves. He will see that they respond to the same chemical tests and exhibit chemical reactions in a precisely similar manner. The only palpable difference in the two cases is, that while in the petals the tint is frequently deepened into orange-red or brick-red, as in many garden flowers, such as marigolds and zinnias, in the autumn leaves the colour due to carotin never passes further than the fiery gold so vividly displayed in the beech, birch or aspen.

On the other hand, the glorious pageantry of the scarlet maple, the crimson cherry and rowan, or the ruddy oak leaf, proceed from a different principle altogether. They appear only when the yellow tint has disappeared, but before the leaf is quite dead and utterly decayed. Sometimes these ruddy splendours do not appear at all, or are but feeble, as in large towns where the air is vitiated by smoke, when we have only a dry rusty brown. In other cases the influence of the season, whether dry or wet, or occasionally frosty, tells very decidedly on the production of these particular tints. A medium amount of moisture and late frost seem to be the conditions most favourable to the greatest brilliancy of autumnal colour effect. Exceptionally dry seasons occurring in a climate generally moist serve also to call forth distinctive crimson in leaves that would otherwise rapidly pass to a dull brown and muddy shade. On what does all this characteristic or exceptional glow depend? It results from a powerful chromogen called tannin, which exists in red and blue flowers as well as in the leaves in greatest quantity in the autumn. I must explain that when a solution of certain kinds of tannin undergoes concentration in the presence of dehydrating acids, or of certain salts, there are produced a series of anhydrides, that is to say, the tannin has given up, or lost, the elements of water, with the result that various coloured substances are produced, of which the lowest or first formed are crimson, and soluble in slightly acid water, while the last formed are red-brown and insoluble. The former constitute the colouring matter of the red, the latter that of the brown and russet autumn leaves. Such being the case, as proved by artificial experiments, we must endeavour to exhibit how the process is carried out in nature under the natural conditions. There must, it is obvious, be a sufficient concentration of the cell sap in the living leaf as it hangs upon the tree. This may be brought about, as is palpably obvious, by a deficiency of the water-supply from without, when the soil and atmosphere are unusually dry. Moreover, this deficiency will chiefly be felt in the case of those leaves which possess, in relation to their size, the largest number of stomata, which, as everyone knows, are the organs of transpiration, that is, the passages in the leaf which permit of water vapour being ejected into the surrounding air.

With regard to the first point, the unusual dryness of the season, I have already hinted that

a great degree of moisture is distinctly unfavourable to the production of fine autumnal leaf effects. In fact, it has been frequently noticed in the analogous case of flowers that an unusually dry springtime causes petals normally white to assume pinkish tints. The second point, the relative number of stomata, demands more positive proof. I shall adduce two instances: one where the tree is known to flourish most luxuriantly in damp swamps or moist localities, for example, the scarlet maple (*Acer rubrum*) of the New England forests. Evidently a tree like this, whose structure is specially adapted to humid surroundings, will be powerfully affected by any temporary deficiency in the supply of water from without; as a special feature of its structure is that the transpiration from its leaves is very great, the number of stomata per square millimetre amounts to about four hundred. Hence the requisite concentration of the cell sap of its broad leaves is easily accomplished, and the colour effect of the surprising blaze of its autumnal tints, once seen, is not readily forgotten. On the other hand, if we consider the case of the common ash we discover something very different. This tree also affects moist situations, but it is not particular as to soil; its leaves are narrow and much divided, or imparipinnate, therefore more liable to become dry than if they were broader and thicker, but they carry only about one hundred and fifty stomata per square millimetre. Hence, in point of fact, they do not readily lose their moisture. Save under exceptional circumstances, they never at any season exhibit any red or crimson coloration. Moreover, as it so happens, the tannin of the ash, unlike that of the maple, does not form coloured anhydrides. Hence if any colour may be produced in its leaves or flowers that would depend on other causes and conditions than those which involve its formation in the corresponding organs of the other denizens of our woodlands. Further, the tint would be like that of a dahlia rather than that of a rose.

Patterdale, Westmorland.

THE BRITISH MYCOLOGICAL SOCIETY.

THE Society held its annual week's fungus foray this year from the 19th to 24th September at Dublin, where the members were the guests of the Dublin Naturalists' Field Club. The energetic and indefatigable local secretary, Professor T. Johnson, D.Sc., is heartily to be congratulated on the excellent programme of arrangements that he made for the excursions, and the subsequent investigation of the finds.

On Monday, September 19th, the members assembled at the Botanical Rooms, in the Science and Art Museum, Kildare Street, which had been kindly placed at their disposal by the Director, Colonel Plunkett; but as no specimens had arrived for identification, a preliminary ramble was organized to Howth. A list of "The Fungi of the Counties of Dublin and Wicklow," by our member, Mr. Greenwood Pim, M.A., reprinted from the "Irish Naturalist" for August, 1898, was presented to each member with the injunction to go one better, and keep our motto ever to the fore, viz., "*Recognosce notum, ignotum inspice.*" Howth demesne proved to be a most suitable hunting-ground, and seemed not to have suffered much from the prolonged drought. Numerous additions to the list were recorded, amongst which we may enumerate a pretty resupinate *Hydnum*, *H. udum* Fr.; one of the scarce tubers, *Hydnotrya tulasnei* B. and Br.; a rather uncommon *Naucoria*, *N. erinacea* Fr.; and a group of the horrent *Lepiota*, *L. acutesquamosa* Weinm. Mr. R. Ll. Praeger, M.R.I.A., President of the Dublin Naturalists' Field Club, received the members in the evening at the Botanical Laboratory, Royal College of Science. The work of naming the specimens was at once proceeded with, and a large collection of fungi was placed on exhibition at the Museum during the course of the week. Mr. Swann, F.L.S., exhibited a splendid series of photographs of the Saprolegnieae, which were of great interest, and contained at least one new to science.

On Tuesday, September 20th, Powerscourt demesne was visited, but the estate had suffered from the long drought, and only a few rarities were encountered, such as the encrusting polypore, *Polystictus wynnei* B. and Br., and growing on fallen holly-leaves was the pretty *Marasmius hudsoni* Pers., whose pileus and stem are covered with long spreading hairs. The club dinner was held in the evening at Russell's Hotel, and universal regret was expressed that their President, Mr. George Massee, F.L.S., F.R.M.S., was unavoidably prevented from presiding. In his absence the members felt themselves adequately presided over by the acting president, Mr. C. B. Plowright, M.D., who subsequently read an important address at the Lecture Theatre of the Royal College of Science, entitled, "Notes and Comments on the Agaricineae of Great Britain."

On Wednesday, September 21st, the morning was devoted to the determination of the specimens collected and also of consignments of fungi, which now came in from all parts of Ireland. In the afternoon a search at Brackenstown, near

Swords, was made, where *Hypocrea splendens*, *Rosellinia mammaeformis* P., *Nolanea pisciodora cesati*, *Poria vitrea* Pers., and *P. obducens* Pers. were found. At the evening meeting a very valuable paper was read on behalf of our member, Mr. Harold Wager, F.L.S., on a "Fungus Parasite on Euglena," in which Mr. Wager recorded his original observations on the life-history of *Polyphagus euglenae* Schroet., which had not previously been so fully worked out; and Dr. C. B. Plowright made some observations on "A Clover-Destroying Fungus," stating that up to the present year he had always regarded *Pseudopeziza trifolii* Fckl. as a harmless parasite, but that this year he had found it to be an injurious one, owing to the stems of clover being affected as well as the leaves. The election of officers then took place, and Dr. C. B. Plowright was unanimously elected President for the ensuing year, and Mr. C. Rea Hon. Secretary and Treasurer. The invitation of the Cryptogamic Society of Scotland to join their meeting next year or the year after was then considered, and it was decided that as next year was their semi-jubilee the year after would be more acceptable, and that the annual meeting of this society next year should be held in the New Forest.

On Thursday, September 22nd, the woods of Ballyarthur were explored, and yielded specimens of *Boletus parasiticus* Bull and countless ascophores of the pretty cup-shaped *Chlorosplenium aeruginosum* De Not. on the green-stained oak wood which was formerly employed in the manufacture of Tunbridge ware. In the evening Dr. C. B. Plowright read a very learned and exhaustive paper entitled "An Epitome of Eriksson's Researches on the Cereal Rusts," a careful consideration of which cannot fail to be of benefit to agriculturists and economists.

Friday morning, September 23rd, was devoted to work at the museum; and in the afternoon the demesne of Woodlands, near Lucan, was investigated, where fine specimens of the rare *Amanita strobiliformis* Vitt. and *Cortinarius* (*Phlegmacium*) *fulgens* Fr. were gathered. In the evening Mr. Greenwood Pim exhibited, under microscopes, specimens of some curious moulds, which included *Botrytis dichotoma* Ca., *Stysanus stemonitis* Ca. var. *ramosa*, *Pimia parasitica* Grove, *Papulospora sepedonioides* Preuss., *Myxotrichum chartarum* Kunze and *M. deflexum* Berk, *Helicomyces roseus* Link, and *Ramularia rapae* Pim, etc., and he added some very interesting notes concerning them. Dr. E. J. McWeeney then made some observations on "Two Sclerotia Diseases of Potato." The one was characterized by large sclerotia in the pith cavity, the other by small crumpled inconspicuous sclerotia firmly adherent to the epidermis of the leaves and stem. The former gave rise to the well-known peziza *Sclerotinia sclerotiorum* Mass., whereas the latter produced a mouse-grey mould, *Botrytis*; but the two were quite distinct, and not stages in a life cycle. To eradicate the disease he advised burning the potato haulm each autumn, and the non-cropping with potatoes of the same ground for some years to come. Mr. Soppitt offered some valuable observations on the Uredineae in general, and more particularly as to the life-history of *Aecidium grossulariae* Gmelin, in the elucidation of which he has done good work for many years past. Mr. C. Rea read a few notes on "The Different Names Applied by English and French Mycologists to One and the Same Basidiomycete." Hearty votes of thanks were then unanimously accorded to the Dublin Naturalists' Field Club, the Royal College of Science, the Museum authorities, and Professor T. Johnson, D.Sc.

Saturday, September 24th, was the concluding day of the week's foray, when the members visited the picturesque demesne of Dunran by the kind invitation of Mr. Patinson, who most hospitably entertained them to luncheon and showed them round his well-kept gardens, which contained many rare shrubs and flowers. The demesne proved to be an excellent collecting-ground, and the somewhat scarce purple spored *Boletus*, *B. porphyrosporus* Fr., was found in some abundance, together with vast clusters of the giant polypore, *Polyporus giganteus* Fr., and a solitary example of a *Hydnum* new to Britain, though previously recorded for the continent of Europe, viz., *H. cinereum* Bull.

Over 430 distinct species of fungi were identified during the week's foray, of which 150 were additions to the list published by Mr. Greenwood Pim, M.A.

CARLETON REA.
Hon. Sec. British Mycological Society.
34, *Foregate Street, Worcester.*

SEPTEMBER, 1898.—September last will long be known as a month remarkable alike for its physical and social events. With the latter we are not concerned in these pages; but among the former were the heat wave and dry period—both exceptional maxima. Generally the rainfall was less than half, and in some cases only reached ten per cent. and under, of the average; absolute droughts occurred at about ten recording stations. This seems to be only part of the abnormal dry period that has affected some portions of Europe for the past four years, during which the average rain has been considerably below what is usual. It applies especially to this year, when up to the end of September every month has been deficient in rainfall. The area in Britain most affected by the phenomenal heat of September was south-eastern England. In certain places as much as 93° Fahr. was the shade temperature, and 85° up to 90° were not uncommon. The hottest days were from the 3rd to 9th and 14th to 17th September; whilst it was on the 9th that the brilliant aurora display took place, following the commencement of the enormous sunspots demonstration, which lasted most of the month.

BOOKS TO READ

NOTICES BY JOHN T. CARRINGTON.

NOTE.—*In consequence of the great variety in sizes of books now published, the old descriptions, founded on the folding of the paper on which they are printed, will not in future be followed in these pages. In its stead their size, including binding, will be given in inches, the greater being the length and the lesser the breadth, unless otherwise specified.—Ed.* SCIENCE-GOSSIP.

The Structure and Classification of Birds. By FRANK E. BEDDARD, M.A., F.R.S. xx + 548 pp. 8¾ in. × 5¾ in. with 252 illustrations. (London, New York and Bombay: Longmans, Green & Co., 1898.) 21s. net.

The author of this book, who is the well-known Prosector and Vice-Secretary of the Zoological Society of London, has founded it upon an important MS. left by the late Professor Garrod, F.R.S., who was also the Prosector to the Society, and who had commenced a work on bird anatomy some time before his lamented death. His successor, Mr. W. A. Forbes, had intended to complete it, and made some notes, with a considerable number of accurate drawings, but death also removed him before the opportunity occurred. So it has devolved upon Mr. Beddard to publish the book before us, and excellently well has he done his share towards its success. Although there are several books and treatises on this subject, there is not anything quite so concise nor so convenient for English readers. The author's opportunities are unrivalled for verifying the published statements of others with regard to the anatomy of birds and for conducting original research into their structure. His laboratory at the Zoological Gardens supplies every convenience, with ample subjects for examination. We have, therefore, in this book not only the experience of former authors carefully checked by one of the best anatomists of the day, but also Professor Garrod's material as left in the MS. referred to. The plan of this work entails three chief divisions, viz.: "The General Structure of Birds," "Reproduction and Renal Organs," and "The Classification of Birds." The latter section occupies by far the larger part of the book, taking no less than 371 pages. The illustrations are carefully chosen and admirably drawn, a large number being from Mr. Beddard's own pencil and some by Professor Garrod and Mr. Forbes. We strongly recommend library committees and others who control the choice of books for students to at once obtain this book, for it is sure to become a classic in its subject.

Smithsonian Institution: Report of the Museum for 1895. xxii. + 1,080 pp. 9 in. × 6 in. illustrated by 154 plates and 382 figures in text. (Washington: Government Printers, 1897.)

"The Annual Report of the Board of Regents of the Smithsonian Institution, showing the operations, expenditures and condition of the Institution for the year ending June 30th, 1895. Report of the U.S. National Museum," is the correct title of this remarkable book. It is beautifully illustrated, many of the plates being quite masterpieces of the art of process reproduction. This Report deals with the general administration. In the year under consideration the Museum contained twenty-eight organized departments and sections, under seven administrative divisions. During that period the Museum was visited by upwards of 200,000 persons, or a daily average of 644 on the 313 days when it was open to the public. The Museum library was evidently of much use to the students or visitors, for upwards of 6,000 volumes were consulted. Besides the general library there were twenty-one sectional collections of books. Part iii. of the report gives a summary of the work done in the various scientific departments, and lastly there are nearly one thousand pages of appendices. Some of the papers in this, the most important part of the book to the general reader, are most valuable. They are eight in number, those devoted to anthropology or ethnology of the North American Continent being three, mineralogy two, natural history of Lower California one, tongues of birds one; and another on the taxidermical methods in use at the Leyden Museum.

Natural Resources of Indiana. Twenty-second Annual Report of the Department of Geology and Natural Resources of Indiana. By W. S. BLATCHLEY. xi. + 1,197 pp. 9 in. × 6 in. illustrated by 25 plates, 2 maps, and figures in text. (Indianapolis: W. B. Burford, 1898.)

The papers devoted to scientific subjects in this report are several. The first gives "The Geological Scale of Indiana," with a section in diagram. This is followed by one on "The Geology of Lake and Porter Counties"; "A List of September Dragonflies of Whitely County"; "A Catalogue of Fossils of Indiana"; a "Bibliography of Indiana Palaeontology"; and an admirable descriptive catalogue of the birds of that state is supplied by Amos W. Butler. This last paper is fully illustrated by numerous figures of the birds, and includes 321 species known to occur in the state, and eighty odd others, more or less hypothetical visitors.

Contributions to the Queensland Flora. By F. M. BAILEY, F.L.S. 34 pp. 8½ in. × 5½ in. and 17 plates. (Brisbane: Edmund Gregory, 1898.)

This contribution to the botany of the Colony of Queensland is devoted to the Freshwater Algae of North-Eastern Australasia. It will be useful to European students of that department of cryptogamic botany for comparative purposes. These Botany Bulletins, of which this is No. xv., may be obtained free on application to the Under Secretary for Agriculture, Brisbane, on showing that the applicant is a worker in the subject.

An Illustrated Manual of British Birds. By HOWARD SAUNDERS, F.L.S., F.Z.S. Second edition, revised, 8¾ in. × 5¾ in. (London: Gurney and Jackson, 1898.) 1s. per monthly part.

Twelve of the twenty monthly parts of this excellent book are now complete. There are several new drawings, some by Messrs. G. E. Lodge and C. H. Whymper; especially notable is one of the flamingo, showing the manner of tucking up the long legs during incubation. The old prints illustrating this bird sitting astraddle on a mound the height of its legs was one of those popular errors which become perpetuated by continuous copying of one author from another. Mr. Saunders is sparing no pains to make this work as completely up to date as possible, and we observe several very recent records and newly-discovered facts incorporated in its pages. Parts 11 and 12 deal with the ducks, and commence the pigeons.

SCIENCE GOSSIP

On November 4th the Geological Association of London ordinary meeting will be a morning dress conversazione, held at 8 p.m., in the Library of University College, Gower Street, W.C.

We have already referred to a proposed work on British dragonflies, by Mr. W. J. Lucas, He is anxious to obtain lists of localities of well authenticated species. His address is 278, King's Road, Kingston-on-Thames.

Sir Archibald Geikie has recently been speaking his mind on science in education in an address at Mason College, Birmingham. After reviewing the condition of science taught in the middle ages and even within this century, he pointed out the present altered views on certain sciences.

Sir Archibald warned the assembled students that though a training in science was admirable and necessary at the present time, science alone "failed to supply those humanizing influences which the older learning could so well supply." Had he in view some persons whose saturation with science, to the exclusion of human nature, makes them, in their writings at least, such unenviable people?

Professor Virchow's address in the second Huxley Lecture, at the opening of the Charing Cross Hospital Medical School on October 3rd, was of exceptional importance. He took for his subject "The Recent Advances in Science and their Bearing on Medicine and Surgery." Speaking in excellent English, he gave a masterly review of the influence of scientific biological research upon modern treatment of wounds and disease.

Another remarkable address was that given by Sir James Crichton Browne, F.R.S., at the opening of the present session of the Pharmaceutical Society of Great Britain. Its subject has caused some grave comment, as he spoke largely on poisons and the readiness and safety from detection with which some of them may be administered by criminally disposed persons.

The report of the Committee appointed by the Treasury to consider the establishment of a National Physical Laboratory has been issued. It recommends that such an institution should be instituted for standardizing and verifying instruments, for testing materials, and the determination of physical constants. It suggests the extension of Kew Observatory for this purpose, and that the Royal Society should have the control of the institution.

We have received from Mr. G. W. Kirkaldy, F.E.S. a reprint of a short article by him on "Water-bugs as an Article of Human Food." It is stated that they make a good fillip to the appetite when eaten after the manner of caviare. In the form of cakes the ova and perfect insects of *Notonecta* and *Corixa* and their allies, are now being introduced into this country by the ton, as food for insectivorous birds, game, fish, etc. It is an interesting paper.

The death is announced of Mr. William Borrer, of Cowfold, Sussex, aged 84 years. He was one of the oldest Fellows of the Linnean Society and a well-known naturalist.

Mr. Edward North Buxton, whose name is well known in connection with Epping Forest as one of its most active verderers, has handsomely presented an additional twenty-eight acres of woodland adjoining and overlooking the valley of the River Lea. The Lord Mayor in Council, on behalf of the City of London, has gratefully accepted this public gift.

We regret to hear of the death of Mrs. Stainton, widow of the late H. T. Stainton, F.R.S., who, a generation ago, did so much to encourage the study of lepidopterology in this country. His well-known "Manual of British Butterflies and Moths" was by far the best work on its subject published in England. It still has a considerable sale, though modern changes in nomenclature have largely reduced its usefulness.

Mr. Thomas Bolas, F.C.S., F.I.C., has consented to give demonstrations of the adaptability of glass blowing and working for amateurs, in the "Photogram" Reading Room, on Thursdays, November 10th, 17th and 24th, from 3 to 5 o'clock and 7 to 9. Tickets of admission are forwarded free on application, with stamped addressed envelope, by Dawbarn and Ward, Ltd., 6, Farringdon Avenue, London, E.C.

We greatly regret to see that the present conductors of "Natural Science" are unable to continue the issue of that journal after next month. We trust, however, some arrangement may be made so as to avoid its stoppage. We hear, also, that the same fate is in store for an even more pretentious contemporary devoted to the more abstruse departments of science. There appears to be something wrong about some modern scientific publications; either the editors do not cater for their readers palatable mental pabula, or else the scientific world is lacking in the support which ought to be as readily given as it is to most other professional journals.

The London "Daily Mail" of October 13th, gravely announces in its largest head-lines, a "New Centipede in England. Curious Entomological Discovery at Colchester." The scientific culture which dictated those words is not less entertaining than that of Mr. Punch's railway porter, who, when discussing dog tickets, classed hedgehogs as "hinsecs." The writer to the "Mail" gives an account of the discovery of a specimen of *Scutigera coleoptrata*, a south European centipede, which, like others of the same species that have occurred in these islands, was probably introduced accidentally. It would have been safer for the writer to have supplied the title as well as the article.

A Paper was read before the British Association at Bristol, by R. D. Oldham, in which he described the great Indian earthquake of June 12th, 1897. The shock was noticeable over an area thousands of square miles in extent. Many bridges were overthrown or otherwise seriously affected, whilst railways suffered considerably by the contortions of the rails forming the permanent way. Great earth fissures appeared, and from numerous vents sand and water were forced to a height of three to five feet above the ground. Huge landslips occurred in the Khasia Hills, and in the Himalayas north of Lower Assam.

CONDUCTED BY FRANK C. DENNETT.

	1898. Nov.	Rises. h.m.	Sets. h.m.	Position at Noon. R.A. h.m.	Dec.
Sun	8	7.8 a.m.	4.20 p.m.	14.55	16° 40′ S.
	18	7.25	4.5	15.36	19° 19′
	28	7.41	3.55	16.18	21° 23′

	Nov.	Rises. h.m.	Souths. h.m.	Sets. h.m.	Age at Noon. d. h. m.
Moon	8	0.24 a.m.	7.10 a.m.	1.42 p.m.	23 23 23
	18	11.52	4.15 p.m.	8.49	4 11 39
	28	3.52 p.m.	12.26	8.10 a.m.	14 11 39

	Nov.	Souths. h.m.	Semi Diameter.	Position at Noon. R.A. h.m.	Dec.
Mercury	8	0.30 p.m.	2″ 4	15.41	21° 3′ S.
	18	0.54	2″ 6	16.44	24° 31′
	28	1.15	3″ 0	17.45	25° 51′
Venus	8	1.51 p.m.	25″ 0	17.2	27° 50′ S.
	18	1.7	28″ 9	16.58	26° 36′
	28	0.9	31″ 5	16.39	23° 58′
Mars	8	5.13 a.m.	4″ 7	8.23	21° 8′ N.
	18	4.46	5″ 0	8.35	20° 48′
	28	4.15	5″ 5	8.44	21° 41′
Jupiter	18	9.56 a.m.	14″ 5	13.46	9° 49′ S.
Saturn	18	0.55 p.m.	7″ 0	16.45	20° 55′ S.
Uranus	18	0.15 p.m.	1″ 7	16.5	20° 42′ S.
Neptune	18	1.46 a.m.	1″ 3	5.35	21° 58′ N.

MOON'S PHASES.

		h.m.			h.m.
3rd Qr.	Nov. 6	2.28 p.m.	New	Nov. 14	0.21 a.m.
1st Qr.	,, 20	5.5 p.m.	Full	,, 28	4.39 a.m.

In apogee November 4th, at 1 p.m., distant 251,500 miles; and in perigee on 16th, at 8 a.m, distant 226,000 miles.

CONJUNCTIONS OF PLANETS WITH THE MOON.

Nov. 5	Mars*†	4 p.m.	planet	3° 41′ N.
12	Jupiter*	11 a.m.	,,	6° 21′ N.
15	Mercury†	3 a.m.	,,	0° 44′ N.
15	Saturn*	11 a.m.	,,	3° 46′ N.
15	Venus†	5 p.m.	,,	2° 19′ S.
16	Vesta†	7 p.m.	,,	0° 10′ N.

* Daylight. † Below English horizon.

THE SUN still shows traces of considerable activity, new small groups being formed since the great disturbance mentioned last month. He should be carefully watched.

MERCURY is an evening star, but too far south for successful observation. On November 12th, at 3 a.m., he is in conjunction with Uranus in the constellation Scorpio, Mercury being 1° 53′ south; on the 20th, at 8 a.m., he is in conjunction with Venus, passing 1° 18′ north of that planet.

VENUS is an evening star, but too far south for observation.

MARS, in the constellation Cancer, rises about 9.25 p.m. on the 1st and near 8 on the 30th. His apparent diameter, though small, is gradually increasing, and many of his markings may be seen with a telescope of comparatively small aperture.

JUPITER, SATURN and URANUS are too near the sun for observation, the last mentioned being in conjunction at midnight on the 25th.

NEPTUNE is now about 1° 40′ east of the crab nebula in Taurus, and in good position for observation.

METEORS should be looked for on November 1st, 2nd, 4th, 6th to 20th, 23rd, 24th and 27th. Considerable displays of the Leonids may be expected from November 7th to 20th, and of the Andromedes on the 23rd and 24th, about which further informa- will be found on page 161 of this number.

GRESHAM COLLEGE lectures on astronomy, by Professor Rev. E. Ledger, M.A., will be given on November 1st, 2nd, 3rd and 4th, at 6 p.m.

Two new minor planets have already been discovered photographically at Heidelberg Observatory by Professor Max Wolf, on September 11th.

THE new Edinburgh Observatory on Calton Hill will probably in a short time be formally opened. One of its instruments is a 22-inch refractor with a focal length of thirty feet.

PECHUELE'S comet appears to be identical with Wolf's of 1884, and to have passed its perihelion on July 4th. It will be nearest to the earth at the end of November, when its distance will be 1·40, that of the sun being 1·0. At the time of its discovery it did not exceed a star of 11th-magnitude in brightness. The next return may be looked for in the spring of 1905.

THE great sunspot group remained upon the sun and again reappeared round the south-eastern limb at the end of September. On October 3rd, Rev. F. Howlett, of Clifton, found the largest spot had an area of 455,000,000 square miles, or only about one-fifth of its size on September 10th. Four excellent drawings were given by an anonymous correspondent in "The English Mechanic" on September 16th.

A NEW comet was discovered on September 13th, 16h. 14·3m. Lick mean time, by Mr. Perrine, of that observatory, in R.A. 9h. 41m. 40s., Dec. N. 30° 36′, and described as brilliant. It was independently discovered a few hours later at Besançon, by M. Chofardet. Its R.A. was increasing about 6·5 minutes daily, and its declination decreasing about 1°. According to Herr Berberich, perihelion would be passed on October 19·9565 Berlin mean time.

THE new minor planet discovered photographically by Herr G. Witt, mentioned on page 153, proves to be a most remarkable object. Its orbit lies within that of Mars. Taking the earth's distance as 1·0, that of Mars is 1·52, whilst the newly-discovered body, according to Herr Berberich, is only 1·46. The nearest point of its orbit is only 14,000,000 distant from our own, and its period 644 days. Its diameter is supposed not to exceed twenty miles. Mr. A. C. D. Crommelin, of the Royal Observatory, discusses the object in "The Observatory." One of its nearest approaches, that is being in perihelion and in opposition at the same time, occurred in January, 1894. As seventeen revolutions are nearly equal to thirty of our years, it follows that we shall have to wait until 1924 before there is an equally favourable opposition. The last opposition was particularly unfavourable, happening when near its aphelion. The next, in November, 1900, occurs about a month before it reaches perihelion, and at a distance of 0·33 from the earth. It will not again be so favourably placed until 1917, when its least distance from the earth will be only 0·15, the least distances of Venus and Mars being 0·27 and 0·38 respectively. Careful observations should be made, therefore, for the more accurate determination of the true solar parallax. In 1894 it would probably have equalled a 7th-magnitude star.

GEOLOGY

CONDUCTED BY EDWARD A. MARTIN, F.G.S.

To whom all Notes, Articles and material relating to Geology, and intended for SCIENCE-GOSSIP, *are, in the first instance, to be addressed, at* 69, *Bensham Manor Road, Thornton Heath.*

GEOLOGICAL EDUCATION.—In conducting these columns of geological gossip, it has been my endeavour to place the science in as pleasant a light as possible to those who are not geologists, in the hope that geology, which still lacks workers in every natural history society, may attract those who have as yet not felt the inspiring influence which it breathes. This journal is always open to record the results of original research or discovery, but I am anxious that our notes should have an educational value, and that they should do something towards getting rid of the feeling of apathy towards things geological, which is so frequently found in scientific societies. We may recall with pleasure the remarks made by Professor Logan Lobley, at Croydon, last June, now brought to mind by the issue of the "Report and Transactions of the South-Eastern Union of Scientific Societies, for 1898": "Some blame is deserved, I confess, by the geological world itself, which is too much inclined to hide its light under a bushel and to rest content with its own acquirements, without doing much for the spread of its enlightening science. I have had much personal experience of this apathy against which I have had to contend, for, clearly seeing the high educational value of geology, the chief occupation of my life has been the dissemination of geological knowledge."

GEOLOGICAL LANTERN SLIDES.—The report of the recent Croydon Congress of the South-Eastern Union shows that a series of seventy-eight lantern slides have been got together, illustrative of the Upper Greensand, Gault and Lower Greensand of the south-east of England. These are in circulation, and can be borrowed on application to Mr. H. E. Turner, B.Sc., 2, Bouverie Street, West Folkestone, who will also lend a written lecture, which he has prepared to illustrate the slides.

PHOTOGRAPHERS AND GEOLOGISTS.—The necessity of an amicable plan of working between geologists and those members of local societies who are photographers only, deserves very great emphasis. We have all heard of the photographer who declined to waste a plate on a section which failed to appeal to him from a point of view of beauty. Geological sections are not always picturesque, but those which are the less covered with vegetation and other attributes of beauty are often the most valuable of any.

LANTERN AND MICROSCOPICAL SLIDES.—I have had considerable experience of Mr. J. Hornell's photographic lantern slides, and have pleasure, therefore, in calling attention to his excellent catalogue, which has just come to hand, of slides and biological preparations. Materials from the Jersey Biological Station may be relied on for trustworthiness, at reasonable cost.

LIGHT AND HEAT OF THE SUN.—The question is frequently raised as to how long the sun has continued to give out light for the illumination of the earth. It is a question which must always interest geologists, and as these are now apparently willing to take their facts in such matters from the physicists, it is well to note that Thomson and Tait calculated that it may have illuminated the earth for 100 millions of years, but certainly not for 500 millions of years. If the earth were suddenly stopped by an obstacle, the earth would emit at once eighty-one times the heat which the sun emits in one day. The earth would fall in towards the sun, and in the collision the sun would, in a few minutes, emit as much heat as it now does in ninety-five years.

TASMANIAN IGNEOUS ROCKS.—In a paper on "The Igneous Rocks of Tasmania," read by Messrs. W. H. Twelvetrees and W. F. Petterd before the Australian Institute of Mining Engineers, the authors point out that field-geology in Tasmania has hitherto resulted in describing the massive rocks simply as granite, greenstone and basalt. A more minute study convinces the investigator that he has here to deal with what is really an epitome of the world's eruptive rocks. The question of classification receives a good deal of attention. Harker has divided the igneous rocks into Plutonic, Intrusive and Volcanic, *i.e.* according to their age, while Geikie, Hatch, Rutley and Teall adhere to the chemical classification. The authors adopt Rutley's scheme, which is of so useful a nature as to tempt me to print it here.

—	ACID. 65·80 % SiO_2. Sp. G. below 2·75.	INTERMEDIATE. 55·70 % SiO_2. Sp. G. 2·70 and 2·80.		BASIC. 45·60 % SiO_2. Sp. G. 2·80 and 3·00.	ULTRA BASIC. 35·50 % SiO_2. Sp. G. 2·85 and 3·4.
Plutonic	Granite	Syenite	Diorite	Gabbro	Peridotite, Pyroxenite, Hornblendite
Intrusive	Elvan	Ortho-clastic Lampro-phyre	Plagio-clastic Lampro-phyre	Dolerite	Picrite
Effusive	Rhyolite	Trachyte	Andesite	Basalt	Picrite-porphyrite
Glassy	Obsidian	Trachyte Glass	Andesite Glass	Tachylyte	—

The only really acid glass in the island is found in the buttons and bolts of obsidian met with in tin- and gold-bearing drifts, but which have indisputably come from an outside source. They are found all over Australia, at Java and Billiton, often hundreds of miles from all volcanic rocks. No satisfactory theory as to their origin has been promulgated, although Dr. Verbeek (Geol. Sur. of Java) suggested they were showered on the earth from lunar volcanoes. However that may be, it is regarded as certain that these lava bombs of late Tertiary age came from no Tasmanian crater.

SEPTARIA AT HONOR OAK PARK.—A layer of septarian nodules in London clay has been exposed by the workmen at the back of the up-side platform at Honor Oak Park Station, London, Brighton and South Coast Railway. The line is here in a deep cutting, and the layer must be about twenty feet from the natural surface. It is quite horizontal, and consists of nodules varying from six inches to a foot in length, and is on a level with the platform.

MICROSCOPY

CONDUCTED BY J. H. COOKE, F.L.S., F.G.S.

To whom Notes, Articles and material relating to Microscopy, and intended for Science-Gossip, *are, in the first instance, to be sent, addressed "J. H. Cooke, Edlestone, Battenhall Road, Worcester."*

To Microscopists.—When engaged on microscopical manipulations the needs of the situation often necessitate the making of simple home-made apparatus and the use of practical expedients. Being of so simple a nature it does not often occur to the microscopist that a knowledge of his methods might be of use to fellow-workers, and thus many valuable hints and methods are lost to all but himself. We would remind our readers that our columns are always open to such suggestions, queries and hints, and that, whenever practicable, reproductions will be made of suitable sketches.

Alcohol as a Hardening Reagent.—As a general hardening fluid there is perhaps none which is so universally applicable as alcohol. Small pieces of tissue not exceeding one-eighth to one-quarter of an inch in diameter should be placed in ninety-five per cent. alcohol. The volume of alcohol used ought to be about twenty times as great as the tissue to be hardened. If less is used it should be renewed at the end of a few hours. It is also advisable to place a small quantity of absorbent cotton in the dish or bottle containing the hardening fluid. The alcohol used for hardening the tissues should be renewed every day for the first three days, and if the pieces are not large, they will be well hardened in four or five days, and may be prepared for further manipulation. Or, if this be not possible, they should be transferred to eighty per cent. alcohol, in which they may be stored away for future use.

Demonstrating Blood Circulation.—Mr. T. O. Mabry, of the University of Mississippi, contributes to the "Journal of Applied Microscopy," an interesting note on a simple and convenient method for demonstrating the circulation of the blood in the capillaries of the external gills and in the transparent tissues of the tail of the tadpole. Tadpoles are to be preferred to frogs for this purpose, because they are more easily obtained and their tissues are thinner and more transparent. In them one can see the branching of the arterioles remarkably well; and the systole and diastole of the heart are plainly noticeable in the alternating increase and decrease in the rate and flow of blood in the capillaries. The principal difficulty met with in the use of tadpoles is their liveliness. This Mr. Mabry overcomes in the following manner: a moist tadpole was placed in a thin transparent sheet of collodion, without pinning and without using a cover-glass. The experiment was a success. The water softened the collodion and made it sticky, so that the tadpole's tail became glued fast. Mount moist, not using too much water, and examine with a two-thirds inch objective.

Tongue of Blowfly.—When the head of a blowfly is severed from the body the tongue is apt to collapse. A slight pressure on the head will expand it. A beautiful specimen of the expanded tongue may be secured by splitting a small stick for a short distance, and, before removing the knife-blade, placing the head between the separated parts. When the blade is withdrawn, the head will be compressed and the tongue expanded. Immerse stick and tongue in turpentine and leave for a few days, after which it will be found well cleaned and cleared, and can immediately be mounted in balsam.

Pond Life on Gelatine Plates.—While examining some ordinary photographic plates under the microscope, Mr. W. G. Levison found an interesting way of catching and holding minute organisms for examination under the microscope. He found numbers of these forms adhering to gelatine-coated photographic plates after the plates had been in the water the usual time allowed for washing them, after coming out of the hypo solution. The number of forms varied with the length of time the plates were in the water. By placing the plates in a box used for washing the hypo from the plates and allowing the tap water to run through it, he collected on them a few large diatoms, many smaller ones, and a large number of small active ones. When the film had become soft, after being in the water several days, Vorticellae and other Infusoria appeared, anchored to the film. His experiments led him to believe that these plates can be successfully used to collect pond life by leaving them a greater or less time submerged in the pond.

Air Bubbles and Oil-Globules.—It is of importance to be able to identify and distinguish between air-bubbles and oil-globules in preparations under microscopical investigation. The appearances of both vary considerably according to the portion of them that happen to be in focus. Dallinger, in "The Microscope and its Revelations," represents and describes these different aspects, as presented when light is transmitted from a concave mirror exactly centred and a diaphragm of about two-thirds of a millimetre is placed at a distance of five millimetres beneath the stage. Air-bubbles in water and Canada-balsam respectively may be examined in a drop or two of either liquid, placed upon a slide with a thin cover super-posed, after vigorously shaking the bottle containing it. A drop of oil or turpentine coloured with magenta or carmine, and a drop of water, may be placed on a slide together, covered, and the cover moved about to cause them to mingle. Globules of oil in water may be studied in an emulsion prepared by shaking the two together with a little powdered gum. In an air-bubble in water, when focussed, the centre of the image appears very bright, and it is surrounded by a greyish zone, which in turn is encircled by a broad black ring interrupted by one or more brighter ones. On focussing downwards the bright centre becomes smaller and brighter, and is sharply divided from a very broad, black ring which has bright diffraction circles outside. An oil globule in water shows the central disc brightest when the upper part is in focus, and the broad black outer circle is not surrounded by diffraction rings. Focussing down to the middle of the globule the disc becomes very large, but is much less bright, and the narrow, black encircling ring is bordered by diffraction circles both within and without.

CONSTRUCTION OF A TOW NET.—Mr. C. A. Kofoid gives the following details in the "Illinois State Laboratory Bulletin" on the construction of a tow net which is inexpensive, durable, and so constructed as to facilitate the removal of the catch for preservation. The bag of the net may be made of fine India muslin. In cutting out the net the muslin should be doubled lengthwise and along a diagonal line passing from *a* to *b* as shown in fig. 1. The top of the net is marked off by striking arcs across the ends of the muslin with a radius equal to the length of the muslin and from *a* and *b* as centres. The cones may then be completed by closing the sides with a French seam. If no bucket is desired at the end of the net it may be closed by the seam *e f*. The condensation and transfer of the catch to a bottle for preservation is, however, more effectively and quickly accomplished if a bucket is used. The place at

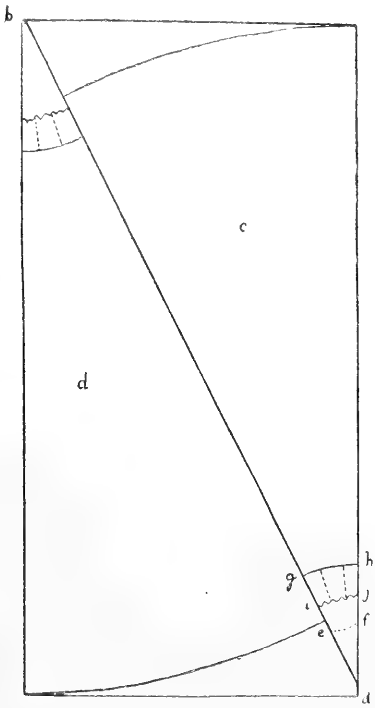


Fig. 1.

which the attachment of the bucket should be made can be indicated by striking the arc *g h*, equal in length to one-half the circumference of the bucket. The tip of the net may then be cut off at *i j* and the muslin slit along the dotted lines to allow for the fitting and fastening of the bucket in place. The top of the net is finished by sewing on the headpiece (fig. 2), which is made of a double strip of strong linen cut bias and having a heavy cord sewn in the upper margin. The net is fastened to the ring which supports the mouth by a series of overcast stitches of heavy thread. The ring *r* should be made of spring-brass wire. At equidistant points upon it are soldered three pairs of hips (*h*) or wire rings, which serve to hold the draw-lines (*d l*) in place. At the junction of the draw-lines a short cord serves as a weight-line (*w l*), to which a weight can be attached when towing in deep water. An inexpensive bucket can be made of sheet copper in the form of a cylinder three inches in height and two inches in diameter. Two light wire rings (*r* and *r'*, fig. 3) are soldered round

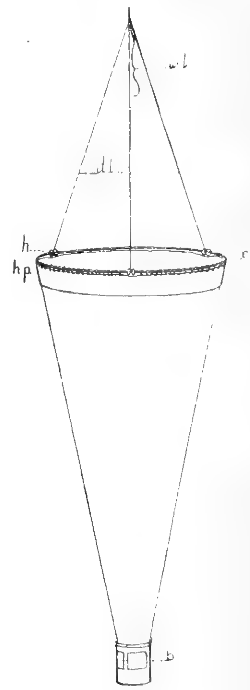


Fig. 2.

the upper end of, and hold in place between them, the string *s*, which ties the lip of the net to the bucket. The bottom of the bucket *b* is formed by an obtuse truncated cone of copper which meets the sides of the cylinder an inch above its base. At its centre is an opening half-an-inch in diameter, which is continued in a short tube (*t*) which reaches almost to the bottom of the bucket

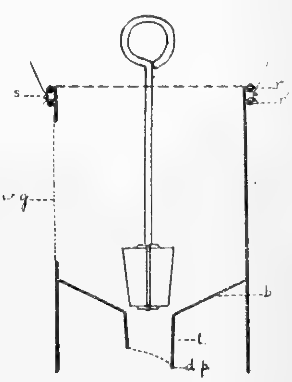
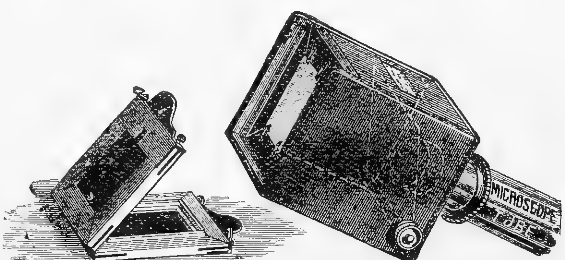


Fig. 3.

and is obliquely pointed, forming a drip point (*d p*). The opening is closed by a rubber cork, the wire handle of which projects slightly above the top of the bucket.

Preparation of Micro-Sections of Lignite.—As a rule the intense blackness of lignite, even in the thinnest of sections, is a serious obstacle to a satisfactory examination under the microscope. To make a successful study with higher powers the specimen must be thin enough to be viewed by transmitted light. It is not often that such sections can be obtained by grinding in the manner usually adopted for cutting rock-sections, for even when the sections are so thin as to break into fragments and be torn from the slide they still remain too opaque for even a ray of light to pass through. Other processes, such as incineration, or boiling in acids, are equally unsuccessful. The method that is best adapted for such materials is that which is recommended by Griffith and Henfrey, in their "Micrographic Dictionary," for the examination of coal. If any of our readers know of equally successful methods we shall be glad to hear of them.

Micro-Photography Simplified.—The delineation of microscopic objects by means of photography has of late years become very popular with a considerable sections of microscopists. There is still a large number who hesitate to take up this useful and instructive branch cf microscopy, and this not so much for the few difficulties that the subject presents, as on account of the mistaken notions that they have regarding the cost of an equipment. For the best results with the least expenditure of time a camera specially designed for micro-photography is desirable; but it is not by any means necessary for doing good work. Through the courtesy of Mr. J. Browning, of the Strand, London, we have recently had an opportunity of trying a micro-photographic camera which, while doing effective work, quite overcomes the difficulty of those who hesitate about taking up micro-photography on the score of expense. The complete apparatus consists of a mahogany camera weighing, with an internal flap shutter, about six and a-half ounces, a focussing screen and a mahogany double-dark slide. It is one of the smallest micro-photographic cameras we have seen, and it is a perfect combination of compactness, portability and lightness. The mode of attachment to the microscope is shown in our illustration. From a personal experience we can vouch for the fact that it is capable of doing fairly critical work, and it is therefore specially suitable for students in the photographing of botanical, entomological and histological specimens. Its cost, 16s. 6d., brings it within the reach of all.



Micro-photographic Camera.

Measurement of Cotton Fibres. — Each individual hair of cotton seed is known commercially as a cotton fibre. As seen under the microscope each such hair has a blunt point, the natural termination of the fibre, differing from its opposite extremity, which shows the fracture occasioned in picking and ginning. To measure these fibres for the purpose of estimating their quality the cotton expert first mixes and then loosely pulls apart a few ounces of cotton, and draws out of this, at random, one fibre, which he places on a glass slide previously moistened with a little weak gum water. The fibre is then gently and carefully smoothed with a camel's-hair pencil and the fingers until straight. This is accomplished under a dissecting microscope with low powers. When straightened the fibre is viewed with the compound microscope, using a magnifying power of about 400 diameters, in order to ascertain whether its natural point is present. If wanting, which is exceptional, the fibre is discarded. A glass micrometer, two and a-half inches long, divided into thirty-seconds of an inch, the lines ruled so as to be visible through the glass, is then placed over the slide holding the fibre and its length ascertained by close and careful inspection.

Reproduction of Bacteria.—There are two methods by which bacteria are reproduced: first, by fission, that is, simply splitting or dividing in half, each new half living and dividing in turn; the second method is by spore formation. Alluding to these modes of reproduction, Mr. L. Atkinson, in a recent lecture, attempted, by calculation, to estimate the rate of increase of these minute forms of life. Assuming a germ divides into two within an hour, then again into eight in the third hour, and so on, the number in twenty-four hours would exceed sixteen and a-half millions. Now forty thousand millions will only weigh one grain, yet after twenty-four hours the descendants of one organism, assuming the necessary food and space could be supplied, would weigh $\frac{1}{2260}$th of a grain, after two days one pound, and in three days 7·366 tons. Of course, these figures are theoretical, and could only be realized if there were no conditions to prevent this incomprehensible increase. Fortunately overcrowding is as fatal to microbes as to the human race.

Glycerine-Gelatine.—After referring to the difficulties met with when objects are mounted in pure glycerine, Professor A. M. Edwards gives, in the columns of the "Natural Science Journal," some results of the experiments that he has made in the use of glycerine-gelatine. His experience with the mixture has been a favourable one. The preparation is made as follows. Take a sufficient quantity of fine gelatine, break it up, cover with cold water and allow it to stand all night. Next morning pour the water off and warm the gelatine in a steaming-pan. When melted add to it a sufficient quantity of strong glycerine. The quantity used varies according to the nature of the specimens to be mounted, but one part of glycerine to five parts of gelatine is an average mixture.

To Correspondents.—I shall be glad, when possible, to reply to correspondents on microscopical subjects through the post, but in such cases a stamped addressed envelope should be enclosed. My address will be found at the head of these columns. I have recently received some sketches made with lead pencil. These are useless for reproduction. A good black aniline dye or Indian ink should be employed.

NOTES & QUERIES

Sphinx convolvuli.—The handsome convolvulus hawk-moth was rather common in England during last September. It is one of the largest of the hawk-moths, and when in good condition is marked with brown on a grey ground colour. Many of the specimens taken are probably immigrants from the Continent, possibly from south-western France and Spain.

Immense Flight of Ants.—Writing to "The Times," Mr. John Braye, of Old Hole, Brightling, Sussex, says, that about three o'clock on the afternoon of September 4th he witnessed the appearance of smoke arising from a clump of Scotch fir trees about a quarter of a mile distant. On examination it proved to be millions of red winged ants, apparently fighting, which lasted until sunset. The ground was thickly covered with dead and struggling ants. The locality is on dry sandy soil, and there has hardly been any rain in the district since August, 1897.

Brachypodium pinnatum in Ireland. — An addition to the flora of Ireland has been found by Mr. R. A. Phillips, of Cork, on some sandhills at Tramore, county Waterford, in false brome-grass (*Brachypodium pinnatum*, Beaur.) In recording his discovery in the October "Irish Naturalist," Mr. Phillips mentioned that near its station there are no houses or cultivation likely to have furnished its origin. Years ago this plant was said to be found in county Cork, but botanists have long ago agreed that some other species was mistaken for it; therefore, the finding of the specimens reinstates a doubtful plant in the Irish list.

Late Arrival of Winter Birds.—Owing to the open weather numerous species of birds have not yet put in an appearance, or are later than usual. Scaup, teal, pochard and gadwell ducks should have arrived with many other shore birds that frequent their former haunts among the rocks and mud-flats near here. Golden plover are scarce, only ten being noticed since last March, although they are plentiful inland. Ringed plovers and dunlins, godwits, curlews and oystercatchers only in small packs not above thirty birds in number. Redshanks and greenshanks are very scarce. Gulls, especially the kittiwake, are conspicuous by their absence. This bird has ceased frequenting the coast round here in any numbers for the past three years, the cause being that they are shot for their wings for the decoration of women's hats. The great black-backed gull is also becoming scarce, neither are the lesser black-backs too plentiful.—*Walter A. Nicholson, Portobello, N.B.; October 4th.*

Botany of Mediæval Monks.—The old monks appear to have been more observant than some people at the present day, as is shown by the following quaint lines regarding the peculiar structure of the calyx of the dog-rose *(Rosa canina)*, and allied species. No botanist to whom I have mentioned this seems to have noticed it, strange to say. I should be glad if any of your readers can assign any plausible reason for the peculiarity. There must be a reason, as nature does nothing, I think, without a reason, and a good one. Two of the sepals have four long acute lobes, two on each side, while two are without lobes, and the other has only lobes on one side. Now, why is this peculiar arrangement, which never varies, as far as my observation goes? What purpose can it serve? The lines are: "Quinque sumus fratres Sub eodem tempore nati. Sunt duo barbati, duo Sunt sine barbâ creati: Unus barbatus, sed barba dimidiatus." Or, "We are five brothers, born at the same time. Two have beards; Two were created without beards; One has a beard, but only on one side."—*A. E. Burr, Bath.*

Entomology near Birmingham.—The following notes upon the Lepidoptera and Coleoptera met with during 1898 within a radius of twelve miles of this city may, perhaps, prove interesting to your entomological readers. Among Lepidoptera *Thecla rubi* was plentiful in Sutton Park about the flowers of holly and mountain ash, but is local, only occurring on the outskirts of one wood; *Lycaena argiolus* swarms in the same park, which is the headquarters for the species in the Midlands; *Sesia tipuliformis*, a few; *Chelonia plantaginis* has been much scarcer during the last two years; *Saturnia carpini* larvae and imagines were fairly common, but always local; *Pterosoma palpina* was bred from pupae found last winter. A perfect example of the rarity *Acronycta alni* was bred from a pupa discovered in a cocoon of rotten wood at Hall Green. Larvae and imagines of *Mammestra persicariae* were both exceedingly common; *Cucullia umbratica* was here met with for the first time; *Heliaca tenebrata* was plentiful in spring in flowery fields near Shirley. Of *Amphidasys betularia* var. *doubledayaria*, a male was bred from a pupa dug last winter. *Nemoria lactearia* was extremely common, but very few have any trace of green about them, even upon specimens freshly emerged; *Ematurga atomaria* is very common in Sutton Park; *Cidaria fulvata* is plentiful in lanes, especially near Hall Green; *C. populata* occurred in Sutton Park; *Tanagra atrata* was scarce and very local. Among Coleoptera *Cicindela campestris* was scarcer this season than is usual; *Bemhedium 4-maculatum*, plentiful, especially under loose poplar bark; *Demetrias atricapillus*, a few; *Badister bipustulatus* was scarce, but generally distributed; *Pterostichus madidus*, *P. niger*, and *P. striola* were all common; *Anchominus prasinus* occurred in great abundance; *Dromius 4-maculatus*, *D. 4-notatus* and *D. meridionalis*, all plentiful under bark; *Gyrinus natator* was plentiful in most pieces of water; *Philonthus trossulus* was found in vegetable refuse; *Tachinus rufipes* is generally distributed and fairly common under moss and in dry rotten wood; *Epuraea aestiva* is plentiful on bilberry bushes at Sutton; *Cercus peduncularis* was common about various flowers in the garden here at Moseley; *Hister unicolor* was found chiefly in vegetable refuse, but not common; *Melegethes aeneus*, enormous numbers in almost every kind of flower; *Rhizophagus bipustulatus* is common in the wood of a rustic arch in the garden; *Coccinella 22-punctata*, one near Elmdon; *Sinodendron cylindricus*, larvae and beetles in wood of a decayed oak near here; *Clytus arietis*, a few near Umberslade; *Calladium violaceum* occurred at Sutton, and *Strangalia armata* near Solihull and Umberslade. An example of *Leiopus nebulosus* was taken sunning itself on palings in Sutton Park. *Dryocoetes villosus* is very destructive to oaks at Sutton. *Erhirrhinus vorax* was common.—*A. D. Imms, Linthurst, Oxford Road, Moseley, Worcestershire.*

SCIENCE ABROAD

CONTRIBUTED BY FLORA WINSTONE.

COMPTES RENDUS (Paris, September 19th). MM. A. Le Chatelier and P. Chapuy, contribute a note on the enamelled colours of porcelain in great heat. They give the chemical composition of various colours. Blue of erbium is composed of eight constituents; erbium green and red, of seven each. The authors are conducting further experiments, the results of which will be published at a future date. MM. Hermite and Besançon give the results of their observation during the ascents of the balloons "Aerophile" and "Balaschoff" in June last. They state that to their great surprise, they have discovered that the balloon "Balaschoff" described, a little after its departure, a complete spiral upon a cylinder with an elliptical base, the axis of which was 600 m. in diameter, and was parallel to the average direction of the wind. The spiral column was probably due to the tempestuous state of the atmosphere. The descent of the balloon was followed by a heavy shower of rain preceded by several peals of thunder. (September 26th.) M. Edward Griffon supplies a note upon the assimilation of chlorophyll by seashore plants. He has been devoting his attention more especially to the flora which is common alike to the seashore and to soils less rich in chloride of soda. The greater number of these plants have a peculiar appearance. They have been described by M. Constantin, in his work upon the "Flora of the Seashore," as being thicker in the leaves, stems and fruit, paler in the green tint, and in some cases having an abundant production of hairs. These conclusions have been verified by M. Lesage, who has compared a number of plants from the seashore and inland. He has also been able to show that it is the action of the salt that produces these changes. In his experiments on the assimilation of chlorophyll by plants on the seashore, M. Griffon took every care when comparing leaves of maritime and inland species that they should be picked on the same day and hour and sent to him from equal distances. He found that the leaves of seashore plants under the influence of sea-salt have less chlorophyll than the same species inland, but they acquire a greater thickness and a more marked development of the assimilating tissue. M. H. D. Maubeuge reports, by letter to the President of the Academy of Sciences, the observation of the green ray at the moment of the sun rising. At six in the morning, he says, just as the sun was rising behind Mount Sinai, at the first second of his appearance a luminous emerald-green ray was observed. The phenomenon was seen by a dozen persons on the steamer "Ernest-Simon." The atmosphere was in a state of great purity. M. Maubeuge concludes from his observations that (1) the phenomenon of the green ray is absolutely objective; (2) that the horizon of the sea is not necessary for this coloration; (3) that there can be no other suggestion to account for the observation, as it was seen simultaneously and instantaneously by several unbiassed people.

COSMOS (Paris, September 17th). M. E. Prisse d'Avennes continues his interesting and well-illustrated article on "The History of Egyptian Arms." In this number he describes various forms of axes and clubs, tracing a decided similarity between the latter in the time of the Pharaohs and those used in the present day by Ethiopians and Arabs. The one figured is made from the wood of the acacia tree, and is ornamented with hieroglyphics denoting that it belonged to the retinue of a Queen of Egypt, but under which Pharaoh is uncertain. The axes of Osiris I. closely resemble tomahawks, both in structure and use. (24th September.) The ivory of mammoths forms the subject of an article by M. W. de Fonvielle. During the tertiary period there were at least four different species of elephants abundant in Europe, especially in France. Of these the last to disappear was the mammoth, *Elephas primigenius*. The skeletons have been found in various places in a more or less perfect state of preservation, and in Siberia in particular the ivory tusks of the mammoth preserved in the natural glaciers are not in a fossil condition, but perfectly fresh and suitable to be used. At Gakoütsk, a small town upon the borders of the Lena, a regular trade is carried on in the tusks of the mammoths, some being exported to China, and a considerable quantity to Europe. (October 1st.) M. G. Espitallier writes on an acetylene generator recently designed by M. Roger de Montais, in which crushed carbide is placed in spherical cases pierced with holes, so that the water can penetrate freely to the carbide. M. L'Abbé Nognier gives an account of the exhibition of Turin, which is universal for electrical exhibits, but exclusively national in other departments. Photographs are given of one or two of the buildings, also of a double-expansion 500 H.P. steam motor, built by Signor Tosi, of Leghorn, and another, vertical, of 250 H.P., giving 270 revolutions a minute. M. A. Duponchel continues his series of papers on a new theory in cosmogony.

THE VICTORIAN NATURALIST (Melbourne, September, 1898). Mr. G. Shephard contributes an interesting paper upon "Some Animals Reared from Dried Mud." After the summer season, in March last, he gathered some of the baked mud at the bottom of a pond at Brighton near Melbourne, and filled a two-ounce bottle from the deepest part of the pond. Having previously failed to rear animals from desiccated pond mud by adding water to it, Mr. Shephard kept it until the rainy season and let nature soak it in the natural manner. The process was quite successful, and the author gives a list of the microscopic animals he found to have emerged. They include Protozoa, Entomostraca and Rotifera; the last in some numbers. The author considers this method of working pond life a very convenient one. By this system he was enabled to study at least three species of rotifers for a period of over one month, and the Entomostraca long enough to go through their development to the adult form. The identification of a butterfly new to the Australian fauna is recorded by Mr. Geo. Lyell, Jun. It was taken near Palmerston, Northern Territory, where it was not rare in January, 1877. The species is *Atella phalanta* Drury, a well-known insect inhabiting Africa, Southern Asia and the Malay Archipelago. There is also an account of an eagle which attacked a dog tending cattle. It lifted the dog, which weighed twenty-five pounds, some height; but the dog seized a wing and held it until a boy killed the bird.

IN MEMORIAM

JAMES HALL.—The geologists of the United States of America have lost a valued colleague by the somewhat unexpected death, on August 7th last, whilst taking his annual vacation, of Dr. James Hall, who for a decade more than half a century has seen service in the Geological Survey of the State of New York. Born near Boston in 1811 and educated at Troy, he graduated in 1832 and became, first, Professor of Chemistry and Natural Science, and then of Geology, in that city. In 1836, shortly after its establishment, he became an Assistant Geologist in the State Geological Survey, and a year later was made State Geologist. During his association with the Survey he formed the large collections of fossils of the state in the Albany Museum, particulars of which have been published under his direction in that splendid work, "The Palaeontology of New York," the thirteen volumes having cost the state something like $1,000,000. In 1855, after refusing an appointment in the Canadian Geological Survey, he became State Geologist of Iowa, and two years later the State of Wisconsin was added to the other two appointments. In 1857 he was President of the American Association for the Advancement of Science at its meeting at Montreal, when he propounded in his address the then new theory of the elevation of mountain chains by the influence of sedimentary deposits. Dr. Hall was known in England by many geologists, and had been a foreign member of our Geological Society since 1848, and was granted the Wollaston Medal ten years later. It was rather as a palaeontologist than as a physical geologist that Hall made his name, for his opportunities and period of work enabled him to describe a multitude of genera and species of extinct animals.

CHARLES EDWARD BEDDOME.—The Australian conchologists have suffered in the death of Charles Edward Beddome, who died at his residence, "Hillgrove," near Hobart, Tasmania, on September 1st, 1898, at the age of sixty-two years. Mr. Beddome shared his love for conchology with his brother, Col. Beddome, of Putney Rise, near London. His career was long and varied. Entering the Indian Navy, he rose to the rank of lieutenant, but retired when that branch of the service was disbanded. He then emigrated to Queensland, where he embarked in pastoral pursuits. For some years he held the office of Police Magistrate, in which capacity he was stationed at Cairns and Thursday Islands. In the latter part of his life he resided in Tasmania. He was chiefly known as an ardent and capable collector, and possessed a superb series of Australasian landshells and Tasmanian marine Mollusca. His literary work was slight and was published chiefly in the "Transactions" of the Royal Society of Tasmania and the Linnean Society of New South Wales. The results of his researches were largely published by Brazier and Petterd. Numerous shells have been called "Beddomei" in his honour. He was a generous donor to the British Museum and Academy of Natural Sciences of Philadelphia. The latter body years ago elected him a corresponding member.

TRANSACTIONS

THE SOUTH LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY.—September 22nd, Mr. J. W. Tutt, F.E.S., President, in the chair. Mr. R. Adkin exhibited a short series of *Dianthoecia nana* (*conspersa*) from Shetland, and read notes on their variation. He also exhibited, on behalf of Mr. Reid, of Pitcaple, a long series of *Taeniocampa gothica*, the result of breeding from selected parents through some four generations, and read notes on the variation; a very distinct form of variation of *Abraxas grossulariata*, in which the black markings were absent from the central areas of all the wings, the discoidal marks only being present; a series of *Melanthia bicolorata* var. *plumbeolata*; and very fine examples of *Pachnobia hyperborea* (*alpina*) from Perthshire. Mr. Harrison, the eggs of the Niger crocodile, and the eggs of a mollusc of the genus *Bulimus* from the same locality. Mr. Lucas, specimens of five of the less common species of British dragonflies, viz.: *Sympetrum sanguineum* and *Libellula fulva* from Sandwich, Kent; *Sympetrum flaveolum* and *Aeschna mixta* from Ockham Common; and *Agrion mercuriale* from the New Forest. Mr. Tutt, a large number of *Zonosoma annulata* (*omicronaria*), bred by Dr. Riding from selected parents to show the hereditary nature of the absence of the annulus. Some seventy-five per cent. of the imagines bred were without the annulus on the forewings. The President, for Mr. Thornhill, a curiously-marked specimen of *Euchloe cardamines* from Cambs, having two wings usually clouded with black; and for Mr. Manger, a box of insects of all orders, captured at sea, among which were *Deilephila livornica*, *Chaerocampa celerio*, *Macroglossa stellatarum*, *Patula macrops*, *Abraxa perampla* and *Acridium peregrinum*. Mr. Dolman, a wonderful specimen of *Abraxas grossulariata*, taken on a tree trunk by a boy, in which the black markings were normal, but having the ground colour of a uniform deep orange; also ova of *Aporia crataegi* from Dover. Mr. Hall, several specimens of an ant found in the burrows of *Sesia sphegiformis*. Mr. Perks, a specimen of the pipe-fish (*Lygnathus*) from Portscatho, the male of which hatches the ova in a large ventral pouch. Mr. West, of Greenwich, bred specimens of the Hemiptera, *Podisus luridus* and *Goniocerus venator*, both from Box Hill. Mr. Turner, a bred series of *Porthesia chrysorrhaea* from North Kent larvae, a larva of *Dicranura bifida*, and a flower of a South African plant, *Orbea* (*Stapelia*) *irrorata*. Mr. Dennis showed the ova of *Thecla w-album* under a microscope. Mr. Edwards, a kitten with an extra toe, more or less developed, on each fore-foot That on the right foot was of the ordinary size.—*Hy. J. Turner, Hon. Report. Sec.*

NORTH LONDON NATURAL HISTORY SOCIETY.—September 14th, 1898.—Mr. R. W. Robbins, President, in the chair. Among the exhibits were, by Miss Martin, *Xyllophila latifolia*, the seaside laurel of Jamaica,—the leaflike branches were broad and flat, and bore minute flowers on their margins; *Mimosa pudica*, the sensitive plant, in flower; *Atropa belladonna*, the deadly

nightshade, in flower and fruit; *Hyoscyanus aegyptica*, or henbane; *Nicotiana rustica*, tobacco plant; *Aponogeton distachyon; Euphorbia lathyris*, or caper spurge; *Vitis corinthia*, the currant vine; *Phytolacea decandra; Ficus carica*, or fig; *Datura stramonium*, or thorn-apple; *Sedium spectabile; Cyperus aquaticus* and *C. longus; Statice limonium*, sea lavender; and *Eryngium amethystimum*, a species of sea holly. Mr. F. P. Smith brought specimens of *Daphina pulex, Cyclops quadricornis, Diatoma vulgare*, etc. A debate was held, entitled "Are Man and Monkey descended from a Common Ancestor?" The affirmative was carried *nem. con.*, but several members present refrained from voting.—October 6th, 1898. Pocket Box Exhibition at the Sigdon Road Board School. Among the exhibits were numerous Lepidoptera, and local plants taken on the occasion of the Society's excursion to Deal on August 18th.—*Lawrence J. Tremayne, Hon. Sec.*

City of London Natural History Society.—Meeting, October 4th, 1898. Exhibits: Mr. A. Bacot, hybrids between *Tephrosia bistortata* and *T. crepuscularia*. Mr. E. M. Dadd, series of *Gortyna ochracea* bred from pupae found on the Lee Marshes. Mr. J. W. Tutt, a cochliopodid larva in spirit, from America, for comparison with the larvae of the British forms *Heterogenea limacodes* (*testudo*) and *H. asella*. Mr. J. A. Clark, *Gonepteryx rhamni* from Eltham, and a dark female *Agrotis puta*. Capt. B. B. Thompson, English, Irish and Scotch specimens of female *Lycaena icarus*, the two latter being nearly a third larger and considerably more suffused with blue than the former. Communications: Mr. Dadd, referring to Mr. Clark's remarks about *Gonepteryx rhamni* being still found so near London as Eltham, said he had taken it at Hadley Wood. Mr. Clark had taken an exceptionally large *Lycaena corydon* at Caterham. *Sphinx convolvuli* was reported as having been common round London this Autumn. Mr. H. Fuller read a paper, "Notes on the Broads," an account of a holiday last June, in company with our members, Messrs. Cox and E. Heasler, in "Broadland." Mr. Dadd also joined them for a couple of days. In the course of Mr. Fuller's remarks, which were of great interest to collectors, he said no less than 109 species of macro-lepidoptera had been captured during the fortnight. He and his friends hired an 8-ton cutter-rigged yacht, together with the services of a skipper, who was also ready to act as cook. Starting from Wroxham they cruised to Horning Ferry, explored the river Ant, and visited Barton Broad, Stalham Broad, Ludham Dyke, Potter Heigham, Horsey Mere, Hickling Broad, Waxham, Whitesley Mere and Ranworth Broad. As inclination led they would choose a collecting-ground and land. An acetylene lamp giving a brilliant light, with its concomitant "sheet," had been provided, but attraction by light was found during this fortnight to be uncertain, the principal insects caught by this means being *Spilosoma urticae, Neuria reticulata* (*sapponariae*), *Meliana flammea, Noctua augur, N. festiva* (vars.), *Dianthoecia capsincola*, and *Nudaria senex*. At blossoms of ragged robin, *Dianthoecia cucubali* and *D. nana* (*conspersa*) were taken. At those of the yellow iris, *Plusia chrysitis, P. festucae, Choerocampa elpenor*, and *Smerinthus ocellatus*. At the white campion, *Choerocampa porcellus, Cucullia umbratica*, and *Dianthoecia cucubali*. By "dusking" were netted *Earias chlorana, Spilosoma urticae, Senta maritima* (*ulvae*)—about a dozen, including one Bond's variety with black orbicular and reniform spots—*Chilo phragmitellus, Dicranura vinula, Hydrelia uncula* (*unca*), *Leucania impudens* (*pudorina*), *Metrocampa margaritaria, Acidalia immutata, Emmelesia albulata, E. decolorata, Phibalapteryx vittata* (*lignata*) and *Lomaspilis marginata*. Some fifteen *Papilio machaon* were captured on the wing and its food plant found, but no larvae were discovered. Sugaring was remunerative throughout the holiday; *Leucania littoralis, L. impudens* (*pudorina*), *L. comma, L. straminea, Xylophasia rurea* and its var. *alopecurus, X. hepatica, Mamestra albicolor, Apamea basilinea, A. gemina*, red-banded *Micena strigilis, Caradrina morpheus, Agrotis vestigialis* (*valligera*), vars. of *A. segetum, A. exclamationis, Noctua augur, N. plecta, N. c-nigrum, N. triangulum, N. festiva* (vars.), *Hecatera serena, Hadena adusta, H. dentina, H. pisi, H. dissimilis* (*suasa*), *Gonoptera libatrix*, and *Cymatophora octogesima* (*ocularis*) being attracted. A large number of larvae of *Leucoma salicis* were taken on willow and successfully reared, and the moths *Odonestis potatoria, Miana bicolorata (furuncula), Bapta bimaculata* (*taminata*), *Hypsipetes trifasciata* (*impluviata*) *Cidaria truncata* (*russata*), *Melanippe rivata* and *Nemoria viridata* were also seen. The following observations were recorded: *Hydrelia uncula* has a curious short rapid flight and buries itself among the grass stems if alarmed. *Chilo phragmitellus* and *Senta maritima* were flying at same spot, and superficially are so much alike that it was not known until the entomologists' return to quarters that the latter good insect was captured. Two bunches of grass on the sand-hills were sugared, but only visited by a dormouse and a natterjack toad. Reed-warblers running up and down the reed stems are sometimes so fearless as to allow one to approach within three or four feet of them before flying away. Various vicissitudes were undergone by the boat and her passengers.—*H. A. Sauzé, Hon. Sec.*

NOTICES OF SOCIETIES.

*Ordinary meetings are marked †, excursions *; names of persons following excursions are of Conductors.*

Clapham Junction Y.M.C.A. Natural Science Circle.

Nov. 2.—†"A Chat on Shells, their form and beauty." J. C. Dacie.
„ 16.—†"London a Million Years ago." Lantern views. W. H. Shrubsole, F.G.S., F.R.M.S.
„ 30.—†"Testimony of the Monuments." Rev. H. M. Mackenzie.
Dec. 14.—†"The Occupiers of Space." C. Nicholson, F.E.S.
„ 28.—†"Art in Nature and Nature in Art." J. Miller-Carr.

1899.

Jan. 11.—†"The Microscope" and Microscopic Demonstration. Arthur Newton.
„ 28.—†"The Light of Olden Days." E. Lovett.
Feb. 8.—†Geological Lecture. Prof. J. Logan Lobley, F.G.S.
„ 22.—†"Interesting Features of Plant Life." Lime-light views. W. H. Griffin.
Mar. 8.—†Lecture on "Chemistry," with experiments. W. G. Whiffen, F.I.C., F.S.C.I.
„ 22.—†"South Africa." Lime-light views. Duncan Milligan, F.R.A.S.
April 5.—†"The position of Insects in regard to Man and their influences on Plants." A. Bacot.

Hon. Sec., F. W. Cannon, 1, Glycena Road, S.W.

North London Natural History Society.

Nov. 3.—†"Henry Walter Bates: his Life and Work." L. B. Prout, F.E.S.
„ 17.—†Discussion: "The Origin of Migration in Animals." Opened by J. A. Simes.
Dec. 1.—†"Solitary Bees and Wasps." W. H. Smith.
„ 15.—†General Business.

Visitors will be cordially welcomed at all meetings and excursions. *Lawrence J. Tremayne, Hon. Sec.*

South London Entomological and Natural History Society.

Nov. 10.—†Exhibition of Varieties.
„ 24.—†"British Shells." Lecture and lantern.
Dec. 8.—†"Dragonflies." Lecture and lantern.

Streatham Geological and Natural History Society.

Nov. 5.—†"Sketches of the Geology of Wiltshire." R. Alexander.

Nov. 19.—†"Carnivorous Plants." A. W. White.
Dec. 3.—†"On a Geological Trip from London to Brighton." J. P. Johnson.
„ 17.—†Annual Exhibition.
1899.
Jan. 7.—†"Some British Birds." G. White.
„ 21.—†"Geology of Caterham Valley." L. W. J. Costello.
Feb. 4.—†"The Inhabitants of a Pond." H. K. Hunter.
„ 18.—†"On the Excursion to Herne Bay." J. P. Johnson.
Mar. 4.—†Short Papers on Summer Excursions.

Hon. Sec., L. W. J. Costello, Callington, Stanhope Road, Streatham, S.W.

METROPOLITAN SCIENTIFIC SOCIETIES.

The following is a list of societies in the London district devoted to natural science, with hours and places of meeting. They may be visited with introduction from a Fellow, Member, or Secretary. Will secretaries send additions or corrections.

Anthropological Institute of Great Britain, 3, Hanover Square. Second and fourth Tuesdays at 8.30 p.m., November to June.

Battersea Field Club and Literary and Scientific Society. Public Library, Lavender Hill, S.W. Thursdays, 8 p.m.

City of London College Science Society, White Street, Moorfields, E.C. Last Wednesday in each month, October to May, 7.30 p.m.

City of London Entomological and Natural History Society, London Institution, Finsbury Circus. First and third Tuesdays, 7.30 p.m.

Clapham Junction Natural Science Circle, Young Men's Christian Association Rooms, Battersea Rise, S.W. Alternate Wednesdays, 8 p.m.

Conchological Society, London Branch, St. Peter's Rectory, Walworth. Irregular meetings. Rev. J. W. Horsley, President, will answer enquiries.

Croydon Microscopical and Natural History Club, Public Hall. Third Tuesdays, October to May, 8 p m.

Dulwich Scientific and Literary Association. Fortnightly lectures Lordship Lane Hall, second and fourth Mondays, 8.15 p.m., from October, for winter season.

Ealing Natural Science and Microscopical Society. Victoria Hall, Ealing. Second and last Saturdays. October to May, 8 p.m.

Entomological Society, 11, Chandos Street, Cavendish Square. First Wednesday, October to June (except January). Third Wednesday, January, February, March and November, 8 p.m.

Geologists' Association, University College, Gower Street. First Friday, 8 p.m., November to July.

Geological Society of London, Burlington House, Piccadilly. First and third Wednesdays, 8 p.m., November to June.

Greenhithe Naturalists' and Archæological Society, 7, The Terrace. First Fridays, 7 p.m.

Lambeth Field Club and Scientific Society, St. Mary Newington Schools, Newington Butts, S.E. First Mondays all the year and third Mondays in winter, 8 p.m.

Linnean Society of London, Burlington House, Piccadilly. First and third Thursdays at 8 p.m., November to June.

London Amateur Scientific Society, Memorial Hall, Farringdon Street, E.C. Fourth Friday in each month, October to May, 7.30 p.m.

Lubbock Field Club. Working Men's College, Great Ormond Street, Bloomsbury, W.C. Excursions second Sundays, Meetings following Mondays, 8 pm.

Malacological Society of London, meets in Linnean Society's Rooms, Burlington House. Second Friday each month, November to June, 8 p.m.

Mineralogical Society. Meets in rooms of Geological Society, February 4th, April 14th, June 23rd, November 17th, 8 p.m.

Nonpareil Entomological and Natural History Society, 99, Mansfield Street, Kingsland Road, N.E. First and third Thursdays, 8 p.m.

North Kent Natural History and Scientific Society. St. John's Schools, Wellington Street, Woolwich. Alternate Wednesdays, 7.30 p m.

North London Natural History Society, Sigdon Road Boys' Board School, Dalston Lane, Hackney Downs Station. First and third Thursdays, 7.45 p.m.

Quekett Microscopical Club, 20, Hanover Square. First and third Fridays, 8 p.m.

Royal Botanic Society of London, Regent's Park. Second and fourth Saturdays at 3.45 p.m.

Royal Horticultural Society, 117, Victoria Street, S.W. Second and fourth Tuesdays, except December to February; 2 p.m. on show days, which vary.

Royal Meteorological Society, 22, Great George Street, Westminster. 3rd Wednesday, November to June, 8 p.m.

Royal Microscopical Society, 20, Hanover Square. Third Wednesdays, October to June, 8 p.m.

Selborne Society, 20, Hanover Square. No winter meetings.

Sidcup Literary and Scientific Society, Public Hall Sidcup. First and third Tuesdays, October to May, 8 p.m.

South London Entomological and Natural History Society, Hibernia Chambers, London Bridge, S.E Second and fourth Thursdays, 8 p.m.

Sutton Scientific and Literary Society, Public Hall Chambers. Second and forth Tuesdays, 8 p.m.

West Kent Natural History, Microscopical and Photographic Society. Meets in School for Sons of Missionaries, Blackheath, third Wednesday, in December, fourth Wednesdays in October, November, January February, March, April, May, 8 p.m.

Zoological Society of London, 3, Hanover Square. Firs and third Tuesdays, 8.30 p.m., November to August.

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Microscopic Slides, about 100 duplicates, exchanged for others, unmounted material, exotic coleoptera or lepidoptera. —R. Handcock, 89, Thornhill Road, Handsworth, Birmingham.

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Wanted, Jamieson's Celestial Atlas, published early in this century. State price; cash or exchange.—John T. Carrington, 1, Northumberland Avenue, London, W.C.

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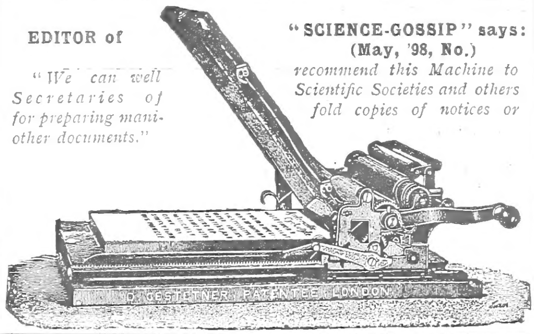

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